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THE JOURNAL of The Department OF AGRICULTURE

VICTORIA · · · AUSTRALIA

Vol. XXXIII.—Part 10. OCTOBER, 1935. PRICE, 3D.

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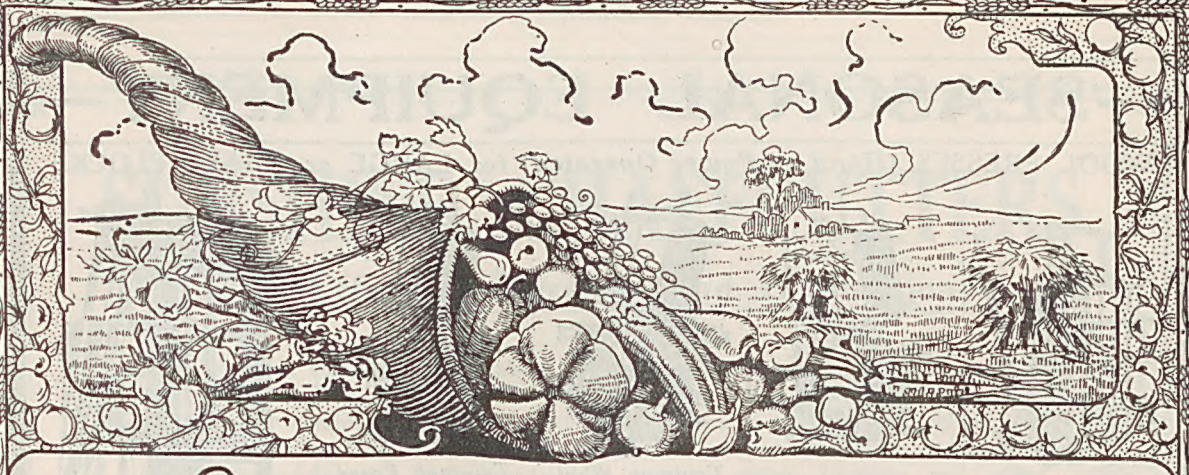

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Issued under the direction of the Hon. E. J. Hogan, M.L.A., Minister of Agriculture.

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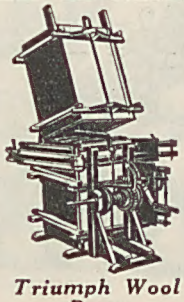

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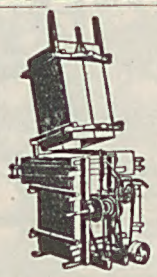

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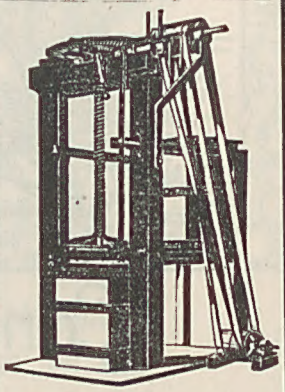

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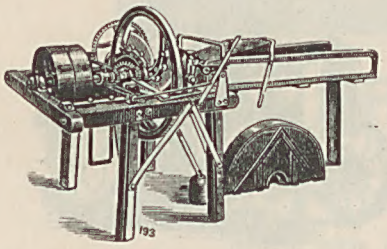

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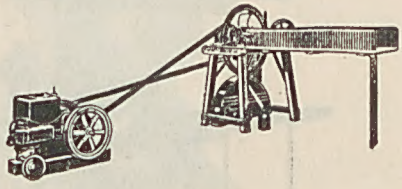

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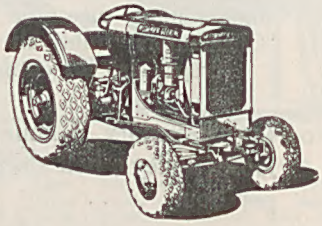

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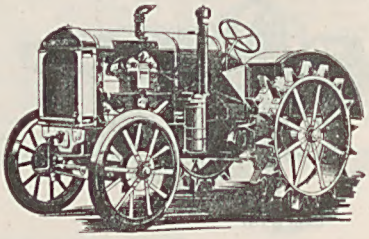

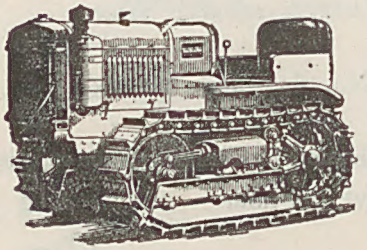

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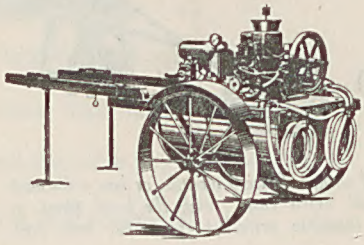

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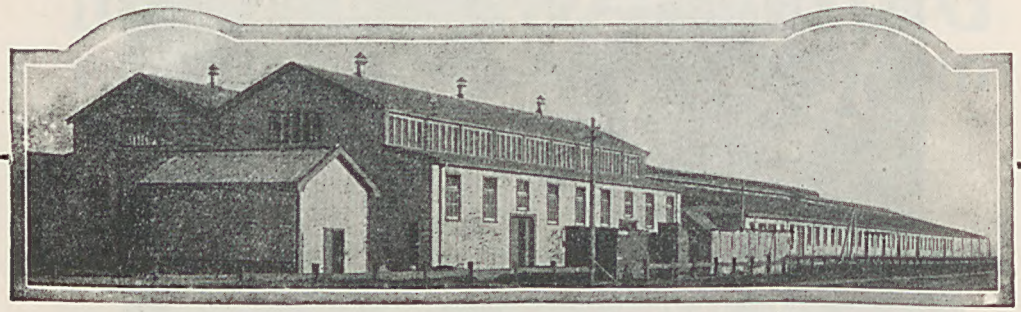

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The Journal of the DEPARTMENT of AGRICULTURE of VICTORIA

Tobacco Investigations

Results of Experimental Work, 1934-35

By W. J. B. McDonald, B.Agr.Sc., Inspector of Agriculture.

(With a foreword by J. Brake, B.Agr.Sc., Agricultural Superintendent.)

THE entry into the tobacco growing industry of many new growers in 1931-32, when Victoria produced its largest crop, and the very serious difficulties encountered by the industry since that time have demanded more attention to experimental and investigational work generally by the Department than had previously been possible because of the limited staff and funds available. At Stockdale in North Gippsland, Markwood in the Ovens Valley, and Shepparton in the Goulburn Valley, field trials were established by the Department. These were designed to yield fundamental information relating to varieties, fertilizing, and the various cultural practices associated with the crop, and some progress was made at these centres.

In 1934, a decided impetus was given to work of this nature when the Commonwealth Government made available a grant to assist the industry, the various States taking responsibility for the furtherance of extension work, field experiments and demonstrations. In this State the existing investigations at Shepparton, Stockdale, and Markwood were extended and a large experimental area, equipped with the necessary barns and scientific apparatus, was established at Myrtleford, where a comprehensive series of tests has been initiated to investigate problems of direct importance to the grower.

At Pomonal also, plots have been established, and although these are not yet as extensive as those at Myrtleford, it is hoped to extend them as soon as the additional officers appointed to the staff become fully acquainted with the technique involved in tobacco investigational work.

Along with the establishment of experimental areas at Myrtleford and Pomonal, seedling beds were set out in eight districts, embracing the greatest degree of climatic extremes available in Victoria. The object was to discover, if possible, districts free from blue mould. Experiments have been carried out also to test the efficacy of various sprays and of special types of seed bed construction from the aspect of disease control within the seed bed. A report on this phase of the work will be published in a later issue of this journal.

It must be borne in mind that field trials with a crop exhibiting so many complexities as tobacco necessarily are of a long-range nature. Variations from season to season in climatic and disease conditions render it quite impossible to place any reliance on results from any period less than, say, three years. It is confidently anticipated, however, that within a few years the industry in Victoria will benefit substantially from the findings of this investigational work.

The experimental work will be the special care of Mr. W. J. B. McDonald, B.Agr.Sc.,

Inspector of Agriculture, although the establishment work during the past two years has occupied practically the full time of both Mr. McDonald and the Tobacco Expert, Mr. Coghlan. As the experimental work is now well established, it is proposed that, in future, Mr. Coghlan shall give close attention to instructional work amongst growers, and with the help of the additional staff it is hoped that the demands of all districts will be satisfactorily met by frequent visits from the advisory officers. Growers will have the opportunity also of attending demonstrations in the cultivation of the crop and the preparation of the leaf for market.

In the following report, Mr. McDonald gives a *résumé* of the year's work carried out by the Department at three of the experimental centres.

Investigations at Myrtleford.

An important phase of the Department's activities on behalf of Victorian tobacco growers commenced in 1934 with the establishment of a comprehensive series of experiments on the property of Mr. James Milne, Merriang Estate. This location was chosen after an inspection of fifteen sites in the oldest tobacco growing district in Victoria, each of which had been offered for the purpose.

Merriang was deemed to be well suited to the purpose in that it combined, on the one property, examples of the three main types of soil in which tobacco is grown in the Ovens Valley. As time goes on, it is hoped to expand the programme of work so that it will cover each of these types. At present the experimental section is confined to an area of river flat, typical of the lighter and sandier portions of the tobacco soils in the valley.

In this particular corner of the farm, a heavy weed growth had been brought under control but a short time prior to the Department taking possession, and this feature may or may not be responsible for a good deal of insect pest damage to our first plantings. Certain it is that many plants on the experimental area were severely attacked by wire-worm, while adjacent areas, which had been cultivated for some years, were relatively free of this pest. The wire-worm is the larva of the click-beetle. It works entirely below ground, and thus is very difficult to combat. It should not be confused with the stem grub, which develops internally in the seedling, and eventually pupates there if not disturbed. The wire-worm bores into the stem just above the

Table I.—Topping and Suckering Trial, Myrtleford, 1934–35.—Grading Results.

Hickory Pryor planted 21st November, 1934 by machine.

——	Yield Per Acre Cured Leaf.	Brights.	M_1.	M_2.	M_3.	Immature Bright.	Immature Mahogany	Dark.	Scrap.	Green.
	lb.	%	%	%	%	%	%	%	%	%
Topped and Suckered	787	19·5	30·9	7·8	20·4	3·8	6·5	4·3	6·5	..
Untopped, but Suckered	584	9·4	12·2	24·0	25·2	2·8	7·5	0·6	18·1	..
Not Topped or Suckered	410	16·7	27·3	16·2	16·2	7.5	..	..	10·3	5·1

Table II.—Furrow v. Broadcast Application of Fertilizer, Myrtleford, 1934–35.—Grading Results.

Hickory Pryor planted 21st November, 1934 by hand.

——	Yield Per Acre Cured Leaf.	Brights.	M_1.	M_2.	M_3.	Immature Bright.	Immature Mahogany.	Dark.	Scrap.	Green.
	lb.	%	%	%	%	%	%	%	%	%
Manure in Furrows, Super., 5 cwt. ..	888	38·9	20·4	11·6	13·7	2·1	4·2	1·8	5·0	2·1
Manure Broadcast ..	816	32·8	20·5	20·5	9·5	4·1	4·1	3·5	2·3	2·3

Experimental plots at Stockdale. Left centre.—Rows of Hickory Pryor, Warne and Conqueror. Right.—Dungowan selection and Dungowan.

root, and eats its way upward, leaving a hollow pipe behind it. Having eaten its fill, it emerges. Fortunately, this particular pest does not seem to be very widespread over the Ovens Valley.

As was the case in many parts of the valley, early planting was delayed by spring floods, and, later in the season, seedlings were exceedingly difficult to obtain. The bulk of the seedlings set out came from Walpeup in the Mallee, and Stockdale in North Gippsland. At planting time the Stockdale plants were the more attractive of the two, but the Walpeup plants subsequently exhibited a greater field resistance to spot mould.

A parcel of seedlings was brought from Tasmania late in the season. These represented the leavings of the Tasmanian seed beds, and as such were not a fair criterion of what Tasmanian plants will do. They were soft, spindly, and badly packed, but despite these characteristics made a surprisingly good strike when set out in the field. To aid their establishment, they were protected from a spell of very hot weather at the planting time by capping with paper. They eventually suffered badly from spot mould in March and April.

About the middle of February, thrip began to appear, and remained until almost the end of April. This invasion rather upset the accuracy of results, as the earlier planted or early maturing plots escaped with relatively less damage than the later maturing plots. Thrip damaged leaf also caused great difficulty at curing where it was found impossible to handle satisfactorily.

TABLE III.—VARIETY TRIALS, MYRTLEFORD, 1934–35.—GRADING RESULTS.

Planted by hand, 22nd November, 1934.

—	Yield Per Acre Cured Leaf.	Brights.	M_1.	M_2.	M_3.	Immature Bright.	Immature Mahogany.	Dark.	Scrap.	Green.
	lb.	%	%	%	%	%	%	%	%	%
Hickory Pryor ..	864	43·0	11·7	9·7	4·7	13·0	2·7	..	5·5	9·7
Conqueror.. ..	888	30·6	7·7	4·8	19·1	5·7	..	11·4	11·4	10·0
Dungowan Selection	1120	21·2	6·6	21·3	14·3	..	4·6	4·1	27·5	1·0
Dungowan* ..	520	14·8	14·8	18·0	26·0	..	..	6·8	15·0	6·0
Adcock	476	13·0	14·2	11·5	21·9	15·4	5·7	..	15·4	3·8

* Owing to the later maturity of this variety, the bulk of it was left in the paddock. The figures given, in all cases relate to the leaf picked and are fairly accurate reflections of the yield from Hickory Pryor, Conqueror, and Adcock. More than half the total crop of Dungowan leaf was not harvested, and a fair proportion also of Dungowan Selection was lost.

It is fairly certain that the thrip were present in the district, and developed during the particular seasonal conditions experienced. Early maturing crops escaped with very little damage, while late maturing crops suffered fairly severely. Careful observation of the seed beds from which the seedlings were obtained failed to reveal any sign of thrip either in the beds or in the districts concerned later in the season. In no case did other crops established from the seed beds under consideration exhibit thrip damage in areas outside the Ovens Valley.

Results obtained from the various plots are set out in Tables I. to VI. One series of tables shows the total amount of leaf cured from each plot, together with the percentage of that yield occurring in each of the grades specified. The grades labelled "Immature Bright" and "Immature Mahogany" contain leaf which is not definitely green, but yet not definitely matured, and which, on further maturation, will become worthy of inclusion in the bright and mahogany grades respectively. The other grades are self-explanatory.

The second series shows the percentage of the total amount of leaf from each plot, which was picked on the indicated dates. This is intended to give growers a guide to the relative ripening rate of each particular plot.

With only one year's results available, it would not be wise to consider any particular point as proven definitely, but one can obtain an indication as to what a series of results may prove ultimately to be correct.

Topping and Suckering Trials.

Careful attention to topping and suckering appears to have increased the yield considerably, and to have hastened the rate of maturity very greatly, but without sacrificing the proportions of leaf occurring in the higher grades. It is necessary to point out here that the untopped plants suffered very much more thrip damage than did the topped plants, due to the difference in maturity. This factor influenced both yield and quality of the cured product.

Variety Trials.

The Dungowan types were the heaviest yielders in this particular experiment. A note on the variety called Dungowan Selection is contained in the Stockdale report. Its main advantage at Myrtleford appears to have been

Table IV.—Standard Manurial Trial, Myrtleford, 1934–35.—Grading Results.

Hickory Pryor planted by hand, 6th December, 1934.

—	Yield Per Acre Cured Leaf.	Brights.	M_1.	M_2.	M_3.	Immature Bright.	Immature Mahogany	Dark.	Scrap.	Green.
	lb.	%	%	%	%	%	%	%	%	%
No manure ..	600	0·5	19·3	19·7	42·0	2·7	5·6	10·6	..	6·8
Super., 3 cwt. ..	704	8·8	13·6	18·2	40·9	..	7·6	3·6	7·6	..
Super., 5 cwt. ..	580	5·1	17·2	15·5	32·7	1·7	3·4	12·0	6·9	5·2
Super., 7 cwt. ..	584	4·8	16·0	20·0	42·8	..	2·0	10·0	2·8	4 0
Super., 5 cwt. + Dried blood, 150 lb.	604	11·6	35·0	12·3	29·0	..	5·0	3·3	5·0	1·6
Super., 5 cwt. + Pot. sulph., 150 lb. ..	592	..	25·0	34·0	18·0	..	6·0	8·0	..	12·0
Super., 5 cwt. + Dried Blood + Pot. sulph.	616	11·3	17·2	15·2	36·9	0·5	4·3	5·8	6·5	2·1

Table V.—Lime v. No Manure, Myrtleford, 1934–35.—Grading Results.

Hickory Pryor planted 13th December, 1934 by hand.

—	Yield Per Acre Cured Leaf.	Brights.	M_1.	M_2.	M_3.	Immature Bright.	Immature Mahogany.	Dark.	Scrap.	Green.
	lb.	%	%	%	%	%	%	%	%	%
Lime, 10 cwt./ac. ..	556	1·7	19·5	24·5	22·8	..	11·8	8·4	..	10·9
No manure ..	564	2·9	35·4	18·7	11·2	..	19·7	8·3	2·1	6·2

a somewhat earlier maturity, with all the benefits relating to that factor. Both these types suffered severely from thrip damage, and the maturity of all varieties was delayed unduly by retaining the seed heads as a source of seed supply. Of the leaf harvested, Hickory Pryor and Conqueror were the most profitable types, with Hickory Pryor holding the advantage in respect to the proportions of the higher grades obtained. On last year's results, it would seem that Adcock is a variety not worth exploiting.

Showing the apparent resistance of Dungowan selection to mould. Other rows are Hickory Pryor and Conqueror.

Fertilizer Trials.

The figures obtained last year indicate that but little advantage is to be gained from distributing the fertilizer in furrows under the site of the row of plants rather than broadcasting it, or drilling it over the field. At the moment, there is not sufficient evidence to show that the extra cost involved would be offset by increased returns.

A comparison of the results obtained from the application of various kinds and amounts of fertilizer indicates that the most profitable dressing under conditions similar to those holding at Merriang last year was 3 cwt. of superphosphate per acre. An interesting feature to growers on poor country is that the introduction of nitrogen in the form of dried blood (150 lb.) to the mixture, has not resulted in loss of colour or increase in the proportion of green leaf.

The addition of potash in the form of 150 lb. of sulphate of potash per acre appears to have a depressing effect on colour. At the moment, there seems to be no justification for using potash at Myrtleford.

The application of 10 cwt. of lime per acre seems to have very little effect on the growth of the plants except that it may have depreciated the colour grade to a certain extent.

Blue Mould Control.

Two hundred and fifty seedlings from each class of treatment practised by the Council for Scientific and Industrial Research in the spray-treated seed-beds at Wangaratta during the 1934 season were set out at Merriang. In no case were the spray treatments an economic proposition under conditions holding last year. The survival of plants from each of the three types of sprayed beds was as follows:—

Colloidal copper	..	13 per cent.
Bordeaux mixture	..	1.6 „ „
Copper emulsion	..	24.4 „ „

Table VIa.—Topping and Suckering Trials; showing Percentages of Leaf Picked at Different Dates.

Picked on	26.2.35.	6.3.35.	13.3.35.	26.3.35.
	%	%	%	%
Topped and Suckered ..	72·5	17·4	2·3	7·9
Untopped, but Suckered ..	30·5	26·0	31·5	12·0
Untopped, not Suckered ..	40·0	25·4	27·8	6·8

Table VIb.—Furrow Application of Super. v. Broadcast Application; showing Percentages of Leaf Picked at Different Dates.

Picked on	26.2.35.	6.3.35.	13.3.35.
	%	%	%
Super., 5 cwt. in furrows	24·4	52·2	23·4
Super., 5 cwt. Broadcast	24·7	64·7	10·5

Table VIc.—Variety Trials; showing Percentages of Leaf Picked at Different Dates.

Picked on	26.2.35.	6.3.35.	13.3.35.	26.3.35.	1.4.35.	27.4.35.
	%	%	%	%	%	%
Hickory Pryor ..	17·1	34·2	29·6	6·9	..	12·0
Conqueror ..	..	26·6	32·5	4·9	13·5	22·5
Dungowan Selection	27·5	14·3	22·2	3·9	20·0	12·1
Dungowan	26·9	20·8	21·5	..	9·2	21·5
Adcock ..	10·9	19·6	21·0	10·1	28·6	10·1

TABLE VId.—STANDARD MANURIAL TRIALS; SHOWING PERCENTAGES OF LEAF PICKED AT DIFFERENT DATES.

Picked on	13.3.35.	26.3.35.	1.4.35.	27.4.35.
	%	%	%	%
No manure	5·6	11·3	32·4	50·6
Super., 3 cwt.	13·6	25·0	21·0	40·3
Super., 5 cwt.	9·0	23·4	27·6	40·0
Super., 7 cwt.	13·7	22·6	26·0	37·7
Super., 5 cwt. + Dried Blood, 150 lb.	12·2	21·8	21·2	45·0
Super., 5 cwt. + Pot. sulph, 150 lb.	8·8	22·0	24·0	45·2
Super., 5 cwt. + Dried Blood, 150 lb. + Pot. sulph., 150 lb.	10·0	24·3	22·8	42·9

TABLE VIe.—NITROGENOUS MANURIAL TRIALS; SHOWING PERCENTAGES OF LEAF PICKED AT DIFFERENT DATES.

Picked on	13.3.35.	1.4.35.	27.4.35.	30.4.35.
	%	%	%	%
Com. Fert. Complete No. 1 600 lb.	19·2	50·7	15·4	15·4
Super., 5 cwt.; Dried Blood, 150 lb.; Pot. sulph., 150 lb.	20·6	40·0	31·8	8·3
No manure	16·4	51·5	17·9	14·9
Market garden manure, 600 lb.	19·1	41·0	21·3	18·4

TABLE VIf.—LIME v. NO MANURE; SHOWING PERCENTAGES OF LEAF PICKED AT DIFFERENT DATES.

Picked on	26.3.35.	1.4.35.	27.4.35.	30.4.35.
	%	%	%	%
No manure	49·5	26·6	9·4	14·4
Lime, 10 cwt./ac.	33·4	34·0	9·9	22·8

South Pomonal and Stockdale.

Results from the experimental areas at South Pomonal and Stockdale are bracketed together because both districts have some features in common, and because some conclusions drawn from the work in Gippsland have a particular significance for Pomonal growers.

In both districts the dominant soil type is a sand or sandy loam—grey in Gippsland, grey to red in Pomonal South—overlying a type of sandstone clay conglomerate, or yellow clay, at about 20 inches. There is, however, a good deal of variation both as regards colour and depth of soil.

Natural summer rainfall at Stockdale usually is sufficient for the needs of the tobacco plant, while at Pomonal it is a trifle light. Virgin soil at Stockdale also probably has a greater productive capacity than that at Pomonal. On the other hand, the crop in the field at Stockdale almost invariably is badly affected by mould during January and February, and this factor alone definitely has prevented this district from establishing itself as an important tobacco growing area.

Pomonal, although not free from field infection, is more fortunate in this respect, and can look forward with some degree of certainty to harvesting a crop once the seedlings have been transplanted safely. In both districts the proportion of dark leaf produced should be almost negligible. In both cases the actual time taken in curing is moderately short, and leaf in the bulk matures rapidly.

POMONAL EXPERIMENTS.

The site of the experimental area at Pomonal was a flat piece of light-red sandy loam, which had already produced one crop of tobacco, and had been left in rough fallow for about eighteen months. The plots are on the farm of Mr. J. K. Rawlings.

Last season's experiments were restricted to fertilizer tests, as it was not possible to obtain clean seedlings of the various required varieties at planting time. The various fertilizer treatments were distributed by hand on 27th November, and harrowed in by cross harrowings. A rather nondescript lot of seedlings was planted by machine on 12th December, and resulted in an excellent strike.

This first planting, which had made excellent growth, was eaten out by grasshoppers in the last week of 1934, and was replanted again on 6th January, 1935. The plots made fair growth considering the disabilities suffered, and leaf was picked on 23rd March, 1st April, 13th April, 23rd April, 6th May, and 10th May, and cured along with the bulk leaf of the grower on whose property the plots are located. Under these circumstances, it was not possible to adjust the curing to suit the particular needs of the leaf from the plots, and hence the general grade of the plot leaf is lower than that which could be obtained were it cured on its own. It is hoped that next season the experimental area will be equipped with an experimental barn.

TABLE VII.—FERTILIZER EXPERIMENTS, POMONAL SOUTH.

Each plot 1/25 acre in area. Check plots—unfertilized. Variety sown—Dungowan—rather mixed in type.

1st Series.—Standard Fertilizer Trials.

Treatment (Per Acre).	Total Yield of Cured Leaf Per Acre.	Grading Results Expressed as a Percentage.						
		1st.	2nd.	3rd.	4th.	Shorts.	Green.	Discarded as Worthless.
	lb.	%	%	%	%	%	%	%
No manure (av. of all checks) ..	531	0·9	7·2	38·0	1·4	14·6	6·7	30·9
Super., 2 cwt.	787	3·8	16·6	27·6	4·2	8·5	17·0	22·1
Super., 4 cwt.	733	4·4	16·3	40·7	3·6	7·2	9·2	17·0
Super., 6 cwt.	688	1·8	13·6	31·8	0·0	13·6	11·8	27·2
Super., 4 cwt. + Pot. sulph., 150 lb.	675	8·6	19·5	26·3	0·0	15·0	11·8	18·6
Super., 4 cwt. + Dried Blood, 150 lb.	868	4·4	15·5	31·1	0·0	10·2	8·8	29·8
Super., 4 cwt. + Pot. sulph. + Dried Blood, 150 lb.	788	1·2	9·3	36·7	10·2	8·2	1·6	34·3

1st and 2nd Grades represent the Brights, 3rd grade Mahoganys, 4th grade, Dark. Shorts on the whole are a fairly good grade about 10 ins. to 12 ins. in length.

The fertilizer experiments were divided into two sections, one in which "untreated plots" were regarded as check plots, and the second series in which plots treated with 4 cwt. of super. per acre were regarded as check plots. The results are set out in Tables VII. and VIII.

Considering the results as a whole, the most definite feature is the indication of the necessity for some class of fertilizer, the untreated plots being definitely lower in yield and quality than those treated with fertilizer. However, in view of the fact that only one season's results are available, it is not possible to draw any definite conclusions as to which fertilizer, or combination of fertilizer, is likely to be the most profitable.

A heavy application of superphosphate alone (6 cwt. per acre) depressed yield without improving quality or reducing the amount of green leaf present in the cured product. This result confirms evidence gathered from other experimental areas where applications of 7 cwt. of superphosphate per acre have exerted a similar effect when compared with dressings of 3 cwt. and 5 cwt. per acre. The most profitable amount of superphosphate to apply to this class of ground appears to lie between 2 cwt. and 4 cwt. per acre. The addition of 150 lb. of sulphate of potash per acre appears to have depressed the total yield, but to have increased slightly the amount of leaf in the two top grades. It is not safe to assume as yet, however, that potash will increase the quality of the cured product.

TABLE VIII.—FERTILIZER EXPERIMENTS, POMONAL SOUTH.

2nd Series.—Super., 4 cwt./ac. as Check Plots.

Treatment (Per Acre).	Total Yield of Cured Leaf Per Acre.	Grading Results Expressed as a Percentage.						
		1st.	2nd.	3rd.	4th.	Shorts.	Green.	Discarded as Worthless.
	lb.	%	%	%	%	%	%	%
Super., 4 cwt. (av. of all checks) ..	562	4·2	15·1	33·8	1·3	14·8	6·5	24·0
Super., 6 cwt. + Amm. sulph., 1 cwt.	702	4·7	15·2	38·1	0·0	19·0	1·4	21·4
Super., 3 cwt. + Amm. sulph., 1 cwt.	724	4·0	16·0	36·0	0·0	17·2	2·0	24·8
Super., 4 cwt. + Amm. sulph., 1 cwt.	733	4·0	13·2	3·5	1·4	13·0	5·0	28·0
Super., 4 cwt. + Nitrate soda, 150 lb.	533	Leaf accidently mixed.						
Super., 4 cwt. + Caster Meal, 450 lb.	535	1·9	14·3	40·4	0·0	7·1	7·1	28·0

1st and 2nd Grades represent the Brights, 3rd grade Mahoganys, 4th grade, Dark. Shorts on the whole are a fairly good grade about 10 ins. to 12 ins. in length.

Nitrogen was applied in a variety of fashions—as dried blood, as ammonium sulphate, as sodium nitrate, as castor-meal, and by means of commercial fertilizers—containing phosphate and nitrogen in the proportions of 6 to 1 and 3 to 1. In most cases the application of nitrogen markedly affected the appearance of the plot, and the total yield. Sodium nitrate and castor-meal were exceptions to this. It is not possible to explain at the moment the apparent failure of sodium nitrate, but in the case of castor meal, the depressed yield was due to a poor strike which was in no way related to the fertilizer. The individual plants on this plot were well grown and of an attractive type.

Nitrogen, except in the case of the castor meal plot, appeared to retard the rate of maturity a trifle, but this apparent effect may have been due to the more vivid green colour of this class of plot creating an impression of immaturity. Certainly the addition of nitrogen has not increased the proportion of green leaf in the cured product. In general, nitrogen carrying plots have a lower proportion of green leaf in the cured product than those not so treated.

If there is any actual difference between the two, the bright grades from nitrogen-treated plots possibly are not quite as bright as those from plots treated with 4 cwt. of superphosphate, the colour apparently being a trifle deeper where nitrogen was applied. It would appear, however, that in the third grade, where the bulk of the leaf occurred, nitrogen adds character and quality to the grade, this being particularly the case with castor-meal.

The aroma of leaf from the various plots differed considerably throughout the block. Probably this was related partly to fertilizer treatment, and partly to soil variation. Several independent observers considered that the leaf from the castor-meal plot possessed the best aroma of the series. In general the application of nitrogen appeared to improve the aroma.

It is again emphasized that until results extending over several seasons are available, definite recommendations as to fertilizer treatment cannot be drawn, but it is suggested tentatively that 400 lb. per acre of either a 3:1 or 6:1 phosphate nitrogen mixture should be used.

Stockdale Experiments.

Stockdale, in Gippsland, differs somewhat from other tobacco growing districts in this State in that, in any season, the crop is liable to severe field infection with mould, though possibly less liable to seed-bed infection than is generally the case. That has been the experience during the last four seasons. Last year the natural tendency toward a heavy field infection was aggravated by an abnormally wet summer.

Fertilizer experiments were planted with seedlings of a selected strain of Dungowan on 31st October, 1934, and varietal trials were planted with Dungowan, Dungowan Selection, Conqueror, Hickory Pryor, and Warne, on 7th November, 1934. The plots are situated on the farm of Mr. G. C. Dunsmuir.

A consideration of the results set out in Tables IX., X., and XI., furnishes some interesting information. Studied alone, this

TABLE IX.—FERTILIZER TESTS.—STOCKDALE, 1934–35.

Grades of leaf expressed as percentage of whole.

Treatment (Per Acre).	1st Bright.	2nd Bright.	3rd Bright.	Mahogany.	Immature.	Scrap, Green, Dark.	Yield of Cured Leaf Per Acre 1934–35.	Yield of Dry Matter Per Acre. 1931–32.
	%	%	%	%	%	%	lb.	lb.
Super., 3 cwt.	14·5	30·9	19·7	10·5	7·9	16·5	469	1,130
Super., 5 cwt.	9·3	33·7	12·8	11·6	13·4	19·2	535	1,192
Super., 7 cwt.	10·7	30·0	17·7	8·2	14·5	19·0	481	1,155
Super., 5 cwt.; Pot. sulph., 150 lb.	13·6	21·4	30·5	6·5	12·3	15·6	473	1,099
Super., 5 cwt.; Dried Blood, 150 lb.	9·4	29·0	21·0	5·0	15·9	18·8	428	1,140
Super., 5 cwt.; Dried Blood, 150 lb.; Pot. sulph., 150 lb.	12·2	46·7	10·0	5·0	12·2	13·7	440	1,187
No manure	23·5	31·1	12·9	7·0	11·7	13·5	526	273

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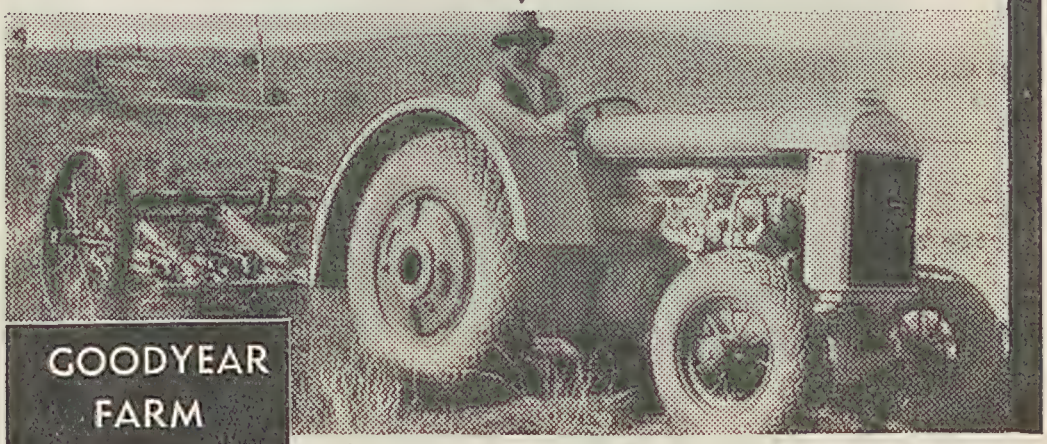

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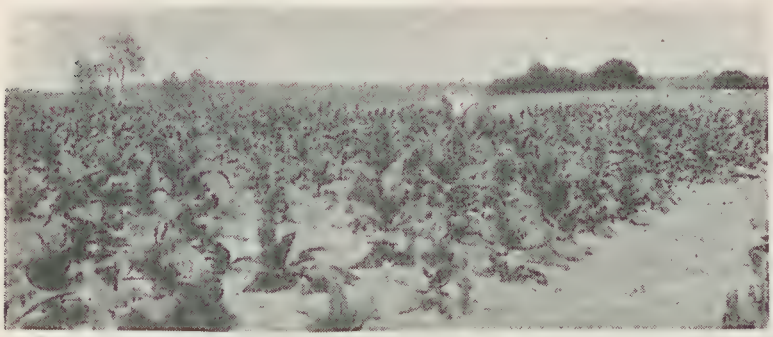


Manurial trials, Stockdale, planted with Dungowan selection.

year's fertilizer trials are not very illuminating as differences were not sufficiently consistent to be significant; but considered in relation to previous year's results they have a particular significance for all growers on poor, sandy country.

In previous years the experimental area has been established on virgin ground, and the one unquestionably significant fact that arose was the utter futility of attempting to grow tobacco on this class of soil without the aid of a moderately heavy dressing of fertilizer. This year the plots were established on similar ground, which had been cleared about fifteen years ago, and which, in the meantime, had been cropped occasionally, and allowed to revert to subterranean clover between croppings. Last season's tobacco crop was preceded by a crop of peas which, in turn, was preceded by a stand of subterranean clover which had been intensively grazed for some years.

Under these particular circumstances, the unfertilized plot was one of the heaviest yielding plots in the series, and produced leaf of excellent quality and colour. The process of occasional cropping with long periods of pasture growth intervening had produced a degree of fertility in naturally infertile virgin ground which apparently was not improved by the addition of liberal quantities of standard fertilizer. In short, the farming practice adopted had increased soil fertility tremendously. This result is of particular interest to Pomonal growers also, since it appears to be fairly certain that their future prosperity will depend on the ability of the growers there to grow rotation crops, and establish clover and grass mixtures on their tobacco areas. It is strongly urged that every Pomonal grower attempt to establish at least a small area of subterranean clover on land that already has carried two or three crops of tobacco. Clovers are great soil renovators, and should add to Pomonal soil something of what it lacks in body and organic matter.

The average yield from individual fertilizer test plots at Stockdale was not high, but this was due to the battering the crop received throughout its growing period from hail, rain, and mould. In addition, a great deal of leaf was lost through the lack of an adequate bulk of leaf to fill the curing barn used at any one time. All the leaf cured was taken in two pickings, hence it will be realized there was a considerable wastage in the paddock.

From this year's fertilizer trials at Stockdale, the important conclusion can be drawn that the suitability of this class of soil for tobacco growing can be definitely and greatly increased by the introduction of clovers and rotation crops.

Variety Trials.

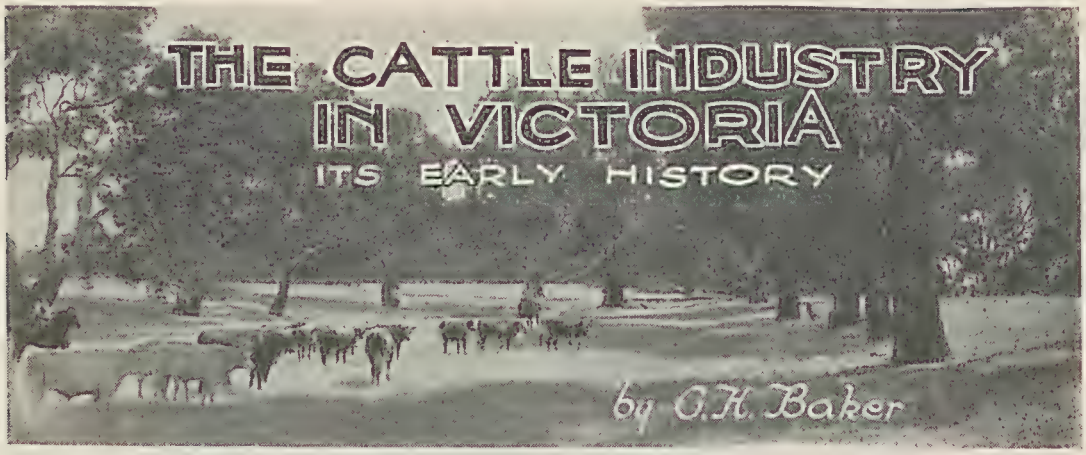
In this series of tests the varieties Hickory Pryor, Warne, and Conqueror succumbed to blue mould entirely. Dungowan and a selected

Table X.—Fertilizer Tests.—Stockdale, 1934–35.

(Super., 5 cwt. v. Super., 5 cwt. + Caster Meal.)
Grades of leaf expressed as percentage of whole.

Treatment (Per Acre).	1st Bright.	2nd Bright.	3rd Bright.	Mahogany.	Immature.	Scrap, Green, Dark.	Yield of Cured Leaf Per Acre 1934–35.
	%	%	%	%	%	%	lb.
Super., 5 cwt.	11·9	34·7	18·0	11·9	10·1	13·2	521
Super., 5 cwt. = Castor Meal, 450 lb.	12·1	41·9	18·2	6·0	12·1	9·4	464

(*Continued on page* 521.)



WHEN, in 1803, some 200 convicts and their keepers were landed as the nucleus of a settlement on the shores of Port Phillip Bay, near where Sorrento has since been built, they brought no cattle, and before there was time for any to be sent, the place was declared to be unsuitable for occupation, the convicts being transferred to Van Diemen's Land.

Nearly a quarter of a century passed by ere a second attempt was made to form a settlement in what is now the State of Victoria About this time there were rumours that the French Government contemplated forming a colony in the south-east of Australia, and the Governor of New South Wales, in order that effective occupation might be established, decided to make a settlement at Westernport. The place chosen was where is now the township of Corinella, and, late in the year 1826, a small party of free men and convicts was landed and remained there for a year or more. The Governor then decided, either because the prospects of success were not bright, or else because the danger of French invasion was passed, to abandon the settlement, and early in 1828 the settlers were withdrawn. Such of the cattle as could be yarded were shipped to Launceston; those which were overlooked, and their descendants, are said to have wandered round the district for years. However, this belongs to the domain of legend rather than history.

In November, 1834, the beginnings of the first permanent settlement were made when Edward Henty reached Portland from Launceston, and put ashore there thirteen heifers and four working bullocks. The number landed was only about half the number that had been shipped, but the 34 days voyage had been a boisterous one. A year or so later the Hentys had a herd of Durhams at Portland, and in a letter Thomas Henty tells of paying £20 for a bull calf of that breed at Circular Head. Whether the herd was pure-bred is not known.

From stories told by the aboriginals, settlers beyond the Murray believed that there was good, grassy country in what is now known as Gippsland, but it was not until early in 1835 that McKillop reached the open country around Omeo, and no stock was brought there until towards the end of that year or the beginning of 1836. In the meantime, the Batman and Fawkner parties, defying authority, settled on the Yarra, and were quickly followed by other settlers from Van Diemen's Land. The stock brought by most of these consisted of sheep, for the transport of sheep was easier than the transport of cattle.

In November, 1835, 50 Hereford cows belonging to Dr. Alexander Thomson, of the Port Phillip Association, were landed at Point Gellibrand (now Williamstown). Just about the same time cattle were brought across the Murray to Bonegilla, where Charles Hotson Ebden established the first cattle station in Victoria. Ebden is remembered partly because of this, but mainly because of the part he took in the politics of the colony.

Very soon there were many people spying out the land, and Mr. Stewart, a police magistrate sent by the Governor of New South Wales to Port Phillip in May, 1836, to investigate the affairs of the settlement, reported that the settlers had spread over an area of about 100 square miles; the number of sheep being grazed at the time was 26,500, but there were only 100 horned cattle.

These new land-seekers were known as squatters—a word used contemptuously in England and America of people with no fixed abode; here, with all the contempt given to it in England, the word was applied to those occupying Crown lands without a licence. It was only when the squatter's claim to his runs was made secure by legislation that the term squatter ceased to be one of reproach.

Gradually people came from Van Diemen's Land, and from the north—some to assess the quality of the new territory; others with the resolve to stay there. One of these was John Gardiner, who liked the prospects, and with two others, Hepburn and Hawdon, decided to transfer cattle from Sydneyside runs to Port Phillip, where they arrived at the end of 1836, after a journey of several months. In March, 1837, the number of cattle in the Port Phillip District was 2,500; by 1842 it had increased to 100,000, and at this time the number of sheep had grown to a million and a half.

With a population of but a few thousands, the only way in which mature sheep and cattle could be turned to profit was by boiling them down for tallow. It is interesting to read that about this time the liquid by-products from the boiling-down works of the Learmonths, near Buninyong, were used to water a small area of cultivated land, and it is said that surprisingly good results were obtained. No earlier instance than this is known of irrigation in Victoria.*

To many it may seem strange that in the ten years between 1840 and 1850 thousands of bullocks were slaughtered for their hides and tallow; indeed during this time hides and tallow made up the principal exports from Port Phillip. The price of tallow was £30 per ton in Sydney, and £45 in London, and ten head of cattle produced on the average a ton of tallow.†

Trouble at times occurred between the newcomers as to the boundaries of runs, but these were days when the world was wide, and agreements were easily made. The country occupied was what was known as "waste lands," and a small annual sum was paid for a depasturing licence, and in addition a stock assessment of a half-penny per head for sheep, and three halfpence for cattle, was imposed. The story of land legislation in Victoria is a long one, and can be given no place in a brief survey of the Cattle Industry; it is a subject for a volume.

In 1851, gold was first found in Victoria. The discovery of bounteous pastures fifteen or sixteen years before had drawn men from other parts of Australia, but now all sorts and conditions of people were attracted from overseas. Every ship brought hundreds—people of all nations. There was an immediate demand for meat; no longer was there any need to dispose of cattle by boiling them down for their tallow. During subsequent years the market was frequently depressed, but at no time was the boiling-down process reverted to.

The Cattle Industry in Victoria, in common with the rest of Australia, received a great setback in 1858 through the introduction of pleuro-pneumonia. In October of that year, five head of cattle were imported by a farmer named Boadle, of the Plenty River district. Immediately the vessel on which they were shipped reached Melbourne, the animals were taken possession of by the owner, for in those days no quarantine was imposed. Shortly after, one of them sickened, and in a few weeks was dead. A little later two of the others died, and from that time onwards most of the cattle on Mr. Boadle's farm were attacked, three or four dying every month.

Post-mortem examinations of the early cases were made, and the cause of death diagnosed as pleuro-pneumonia, but it was not until twelve months later that any attempt was made to stamp out the disease. Its persistent and deadly nature caused great uneasiness, and in September, 1859, a meeting of stock-owners was held at the office of the Port Phillip Farmers' Society to discuss the problem. It was decided to raise a fund for the purpose of purchasing and destroying all the cattle then on Mr. Boadle's farm. This was done, and the farm was placed under quarantine. But by this time the disease had spread far and wide, and was causing great havoc. A Royal Commission appointed to inquire into its origin and nature presented two reports. In the second, dated December, 1864, it was stated that "in not one single case has the disease been communicated to any healthy animal under experiment."

However, evidence was soon to come that the disease was contagious. Some of the animals used in the experiments were purchased by butchers at Geelong, and on being killed were found to be so diseased with pleuro-pneumonia as to be unfit for food.

From 1860 to 1872, the average annual loss of cattle from pleuro-pneumonia throughout Australia is recorded as 125,000 head. For the first few years after its introduction it was

* Journal of the Institution of Engineers, Australia, Oct., 1934, p. 389.

† Pastures New, by Billis and Kenyon, p. 92.

operating on new ground, and so great was its virulence that it is believed 75 per cent. of cases were fatal. In August, 1871, however, a report submitted to Parliament stated that the prevalence of the disease had diminished, and that its attacks were less fatal than they used to be. The disease has never been stamped out of Australia, although it has been practically eliminated from Victoria.

Of course, the great increase in population following on the discovery of gold increased the demand for butter, which was supplied to centres of population in casks, and was usually spoken of as "potted butter." As early as the sixties experiments were made in the sending of butter overseas. Premiums were offered by the Council of Agriculture for samples which were to be subjected to the test of being sent to England and back before being judged. In a report dated 10th November, 1865, the judges said, "We find some of the samples examined in very good condition, and such as would have readily commanded a sale in the English market." But many years were to elapse before a beginning was made in overseas butter export.

With the passing in the sixties of legislation the object of which was to "unlock the lands," the number of dairy farms increased. Butter-making was entirely a home industry until about the end of the eighties, when the first creameries and butter factories were established. In 1888 a factory was opened at Cobden, and several others followed in quick succession. At Kilmore, the gaol was converted into a butter factory, and the first butter-making plant at Rosebrook was installed in a disused flour-mill.

It was about this time that the Government of the day decided to set apart a sum to be paid as a bonus on butter exported from Victoria, and in the year 1889-90 the quantity sent overseas was 369 tons; six years later it had risen to 11,600 tons.

In the forties, some of the large cattle-owners formed a company for the export of salt beef, but a shipment to England arrived in poor condition, and had to be thrown into the sea. Then an endeavour was made to establish a trade in dried or powdered meat, known as "portable soup" and "concentrated gravy," but this, too, was unsuccessful; whether the failure was due to prejudice or to an inferior article cannot now be determined.

In 1859, a meat preserving company was formed at Warrnambool, but it failed in its object of establishing an overseas meat market.

A Champion Shorthorn bull.

The S.S. Strathleven, which carried the first shipment of frozen meat from Australia to England in 1879.

In 1861, Thomas Sutcliffe Mort built at Darling Harbor, Sydney, the first freezing works in the world,* and thus a solution was found for disposing of Australia's surplus beef.

The Rev. Ernest Mort, in a letter written in the early part of the year 1930, said that what first gave his father the idea of freezing meat was an account he had read of how a prehistoric animal was found when a glacier in northern Europe broke and disclosed the body in a state of perfect preservation. Mr. Mort tells that his father "thumped his fist on the table, and said, 'I have discovered the secret of how Australia's abundance may supply Europe's need.'"

In 1876, Mort arranged for a trial shipment of frozen meat to be made to England, but just as the boat was about to sail an ammonia pipe burst in the freezing plant, and the experiment had to be abandoned. It was not until 1879 that another shipment was arranged, and by that time Mort was dead. This shipment was sent by the s.s. *Strathleven,* which had been fitted with dry air compression refrigerating machinery. The total cargo of beef and mutton was only 34 tons, and the vessel, whose gross tonnage was 2,436 tons, left Australia at the end of 1879, and arrived in England on the 2nd February, 1880. A report says that the meat reached England in a perfectly sound state, frozen quite hard and covered with an artificial rime.

In the year 1900, over 4,000 cwt. of beef was frozen at freezing works in Victoria. During the same year nearly 440,000 sheep and 5,000,000 rabbits were frozen. In the year 1932-33 the quantity of frozen beef exported was over 60,000 cwt., while Australia's total shipments in that year amounted to 1,375,000 cwt.

Pedigree Stock Imported.

It is believed that the Messrs. Bolden Bros., who came out in 1839, were the first importers of pedigreed cattle from overseas. The cattle introduced prior to this were bred up from importations from Tasmania, and included strains of "Durham" cattle—the name given to Shorthorns by many early fanciers. As mentioned previously, Dr. Thomson landed a shipment of Herefords at Williamstown in 1835; these, too, had come from Tasmania.

The cattle introduced by the Messrs. Bolden Bros. were of undoubted lineage, and came from the leading Shorthorn studs in England, but just whether they were a combination of the Bates and Booth strains, or clean-bred "Bates" or "Booth" is not clear. Undoubtedly, however, they were high class cattle of the big, roomy, heavy-fleshed type, and for very many years Shorthorn cattle of this conformation prevailed in Australia. But human nature is fickle, and the taste for heavy meats disappeared, causing breeders to raise a quicker maturing animal that was available for slaughter at an earlier age.

Unfortunately, the Messrs. Bolden Bros. met with considerable difficulties and disappointments, and a few years after founding their herd in the Hopkins district, they left there for a more settled locality. More astute breeders, among whom were Mr. Ware, of Minjah, and Mr. Thomas Manifold, secured the pick of the herd. Later, with the stocking of western New South Wales and Queensland pastures, a demand set in for stud cattle, with a consequent boom in prices. New breeders came into the business, and England was searched for the choicest specimens of the breed. The boom lasted from 1870 to 1880, the peak years being from 1875 to 1878. During these years, among the leading breeders was Robert Merlin, of Mount Derrimut, whose herd, capably managed by that born master breeder, the late John James, started from a few head especially selected in England by Mr. James,

* Annual Proceedings—The Victorian Institute of Refrigeration, 1929-30, p. 35.

was developed into the outstanding herd in Victoria. At the annual sale of 1874 of cattle from this herd high prices were realized all round, the top price being 1,000 guineas for a young bull, which fell to the bid of Francis Todhunter, of Macquarie River, while Ross and Co., Bulloo River, secured another for 600 guineas. The annual sale of 1875 was even more successful, the 36 head submitted realizing £14,605, and in this year the balance of the herd was sold to Messrs. Robertson Bros., Colac, for an average of £1,000 per head, £27,000 being paid for the 27 head. The imported bull Oxford Cherry Duke, which had been specially selected in England for the stud by Mr. James, realized £2,500, a price justified by the quality of his progeny, which made the record average of £458, beating any previous average in any part of the world. Prior to the purchase of the whole herd, Messrs. Robertson Bros. purchased the imported Earl of Geneva at £1,600 guineas.

The Messrs. Robertson Bros. then became the premier breeders, and their cattle came into great favour. Buyers from all parts of Australia and New Zealand attended their sales, phenomenal prices being paid for the choicest specimens. At the January sale in 1876, the late Mr. Sam Gardiner paid 2,200 guineas for the Roan Duchess, a heifer, and for the 24th Duke of Derrimut 2,400 guineas.

In January, 1878, the stock submitted realized £25,811 2s., the stud Shorthorn heifers making the magnificent average of £1,102 10s., and the bulls £792 15s., and this during a year of depression due to an unusual drought.

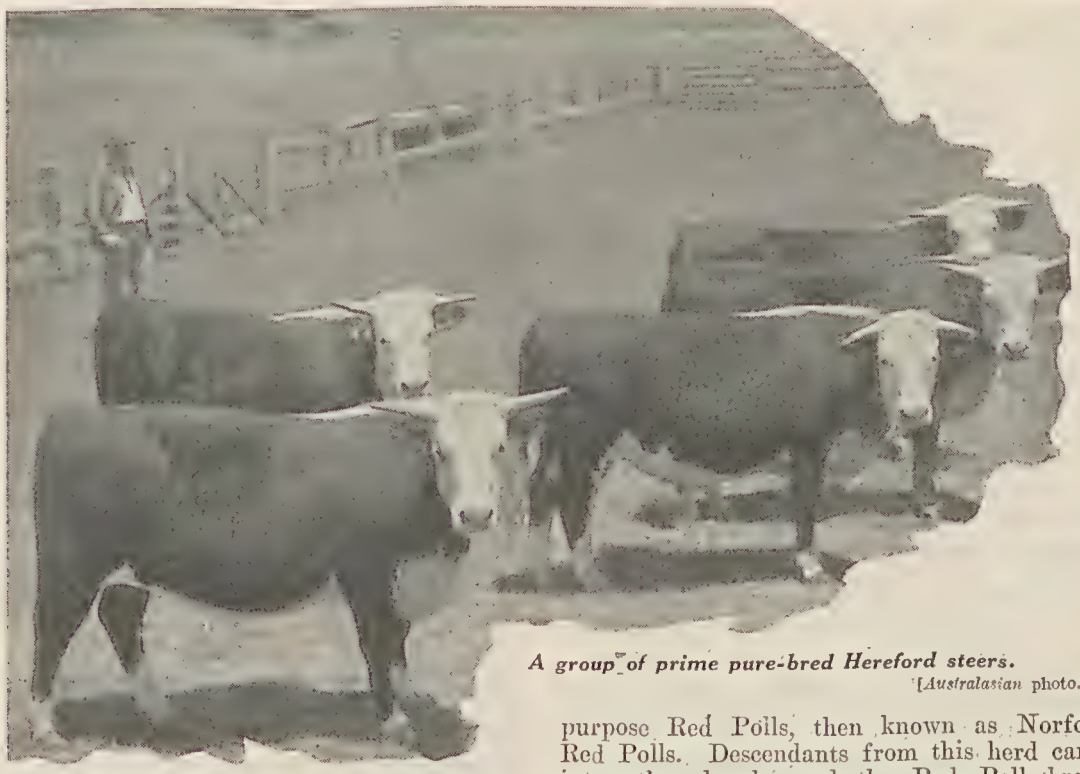
During 1878, the herd founded by Messrs. C. B. and Hurtle Fisher was submitted to auction, and high prices were obtained for the best stud animals, the stud sire, Duke of Tregunda 8th, being purchased by Mr. Sam Gardiner, Bundoora Park, at 4,000 guineas.

Other Shorthorn breeders who played a prominent part in breeding and distributing high class cattle were Messrs. Neil Black, of Mt. Noorat; Robert McDougall, of "Warlaby," Oaklands Junction; and James McCulloch, Woodlands, who spent considerable time in England selecting foundation animals for a stud here, and who brought out some of the best "Bates" blood obtainable.

While these breeders were developing the beef strains of shorthorns, a group of breeders in the Ballan and Bacchus Marsh districts were maintaining and developing dual purpose shorthorns. This group included Messrs. Kerr Brothers, "Morven," Bacchus Marsh; Robert Lidgett, "Highton," Myrniong; and Mr. L. Dugdale, Bacchus Marsh. To maintain the standard of their herds they used only imported sires or sires bred from the best imported blood. Their aim was to produce cattle of hardy constitution with big frames, capacious udders, and heavy milk yield. Mr. Whitechurch, of Mangalore, also figured prominently with these breeders in raising animals that have served the dairying industry well. Mr. W. K. Atkinson, the leading breeder of dairy Shorthorns in Victoria to-day, founded his herd with animals purchased from these breeders. Members of the Kerr, Lidgett, Dugdale, and Whitechurch families are still active breeders of dual purpose shorthorns, and are regular exhibitors at the Royal Show of Victoria.

When Mr. A. S. Chirnside purchased Coragulac Estate, Colac, some 45 years ago, he decided that the dual purpose or milking Shorthorns would be the ideal breed for the rich pastures of the Western District of Victoria. During a visit to England, he personally selected ten animals of the breed as a foundation for a stud, acquiring specimens from the most noted studs. The animals he purchased were all descended from families

A typical Shorthorn cow.



A group of prime pure-bred Hereford steers.
[*Australasian* photo.

with good milk records. To head the herd he secured the stud bull "Woodman," bred by Lord Rothschild. "Magna Charta," the sire of "Woodman," was a noted sire of heavy milking cows, while his dam also was a heavy milker, and came from a famous tribe of heavy milkers. This stud was maintained for years, and descendants from it found their way into many dairy herds in the district.

Herefords have played a leading part in establishing the beef cattle industry in Victoria. Their robust and hardy constitution, together with a natural aptitude for foraging in rough areas fitted them for the mountain range and foothills, where they are grown before being taken to the better pastures of lower areas, where they rapidly fatten into marketable weights. Cattle of this breed have been bred for very many years on the estates of "Murndal," Hamilton; "Weerangourt," Hamilton; and Fernside Station, Scott's Creek. Messrs. Yelland and Sons, Newlyn, and the late Henry Beattie, "Gisborne," Mount Aitken, and later his son, J. A. Beattie, and Mrs. Biddlecombe, Golf Hill, have bred some of the finest cattle raised in the Commonwealth.

The late Hon. J. Graves, Mount Battery, Mansfield, was the first breeder of the dual purpose Red Polls, then known as Norfolk Red Polls. Descendants from this herd came into other hands, and the Red Poll breed to-day is playing a big part in the beef and dairy industries of the State.

Dairy breeds were early established in the State, the Ayrshires being introduced in 1848, in which year Captain Hutton on the sailing vessel *Martin Luther* brought out the famous cow "Annie." Jerseys, then known as Alderneys, were introduced many years later, and it was not until the advent of the Standard Herd Test in 1913 that they gained their present day popularity. Early in the eighties the late Mr. Fred Peppin brought the first Friesian cattle to Victoria, the shipment consisting of five females and a bull. The first Guernseys were introduced to Victoria some 40 years ago by Mr. H. S. Rudduck, who has maintained a herd of them ever since.

By the Customs Act of 1878, a duty was imposed for the first time on all stock coming into Victoria. The sum chargeable was 5s. per head on cattle, and a similar amount on horses, 9d. a head on sheep, and 2s. a head on pigs. The charges were aimed chiefly against New South Wales, for it was from there that most stock imports came. From time to time protests were made against the duty—or stock tax as it was called—but it remained in force until the Commonwealth

came into being in 1901. It is interesting to recall that one of the arguments of some of the opponents of Federation was that the free entry of cattle into Victoria from New South Wales would mean the ruin of our pastoral industry.

With the increase of dairying in the State, and of the breeds found best suited for the production of milk, there has been a falling off in the raising of beef cattle throughout the State, and to meet the beef requirements of Victoria some 50,000 head of store and fat cattle are brought here annually from northern States.

Victoria, however, can still claim to be the leading stud stock centre of Australia. Breeders here have been the first to recognize the change in the kind of meat now required by consumers. At one time, big joints of mature beef were sought for; to-day the demand is for young, firm, mellow beef. Only a few years ago, breeders aimed at raising a large-framed thick-fleshed animal that required years to mature and fatten; sometimes they were not marketed until they were eight years old.

It was the same in England. Breeders there found the cost of fattening the heavier type of bullock too great, and were forced to sell their stock while they were still young, and it was found that the public was ready to pay a big price for the beef this class of animal yields. Scotch studmasters set about improving their herds by selection, and to-day their cattle are in demand the world over. They are short, compact, nuggety, thick-fleshed, and mature earlier than did the animals from which they are descended. In America, polled strains have been bred, and hornless Herefords and Shorthorns have been developed as well as Red and Black Polled cattle. Those who have seen the great deal of bruising that takes place among horned cattle during transit to the sale-yard know the great advantage of hornlessness in stock, and all the hornless breeds mentioned above are now to be found in Victoria.

The home market is always the best market, and with an under supply of the best class of beef, it will be many a year before breeders here will have to look overseas for a market for their beef. The requirements of the beef consumers of Victoria total approximately 8,000 head per week, and this demand should be well within the possibilities of Victoria producers.

But while the standard of our beef cattle studs is very high, it cannot be said that the graziers engaged in the production of meat have given the same attention to improving their standards and methods of production as the dairy farmers have given to their industry.

A splendid Hereford sire.

It can be assumed, therefore that with the breeding of better and still earlier maturing cattle, the subdivision of properties, top-dressing of pastures, and the provision of fodder for lean periods, Victoria could become independent of interstate supplies of beef cattle.

From the following table it will be seen that in the year 1933-34 beef cattle were scattered fairly generally throughout the State, and that their numbers equal or exceed those of dairy cattle in practically all centres.

District.	Dairy Cattle.	Other Cattle.	Total.
Central ..	170,582	163,371	333,953
North-Central ..	43,802	68,545	112,347
Western ..	229,001	237,789	466,790
Wimmera ..	26,582	31,472	58,054
Mallee	29,146	32,104	61,250
Northern ..	132,282	167,368	299,650
North-Eastern ..	87,748	181,483	269,171
Gippsland ..	191,044	209,976	401,020
1934 ..	910,187	1,092,048	2,002,235
1933 ..	887,996	1,012,926	1,900,922
Increase ..	22,191	79,122	101,313

The number of beef cattle raised annually in Victoria has progressed steadily as evidenced by the following return for the period 1861 to 1933.

Year.	No. of Beef Cattle.	Year.	No. of Beef Cattle.
1861 ..	525,000	1921 ..	995,154
1871 ..	564,534	1931 ..	760,788
1881 ..	957,069	1932 ..	861,992
1891 ..	1,387,689	1933 ..	1,012,926
1901 ..	1,080,772	1934 ..	1,092,048
1911 ..	878,792		

The returns from these cattle have been influenced by seasonal conditions and market prices, but because of the mountain ranges dividing the State through the centre from east to west, Victoria as a State is in the happy position of never experiencing dry conditions in all parts at the same time, while our splendid railway system enables pastoralists to move their stock rapidly from dry areas to places where feed is plentiful. Consequently the herds of the State have never been devastated as have those of other States and other countries.

Statistics for 1934 show a cattle population of 2,002,235 head (dairy and other cattle)—a record for the State, and an increase of 101,313 over the figures of the preceding year. Between March, 1933, and March, 1934, the number of dairy cattle increased by 22,191, and other cattle by 79,122. In addition, approximately 50,000 were brought into Victoria from other States—the bulk going direct to the abattoirs.

The cattle industry of Victoria has always been of immense value to the State, and has maintained its position as one of the most important primary industries, despite the larger areas that have gradually been given up to dairy farming, sheep raising, and cultivation. That this has been possible is due mainly to the considerable improvement in methods of pasture management, including the adoption of top-dressing, which has been so strongly advocated by the Department of Agriculture. Largely owing to the vigilance of stock inspectors and the rigid quarantine of oversea importations of stock, our herds have been maintained free from many forms of contagious diseases and animal pests with which other countries are afflicted.

Infectious Laryngotracheitis

A Disease of Poultry

By Harold E. Albiston, D.V.Sc., Veterinary Research Institute, University of Melbourne

IN 1924, a hitherto undescribed disease of poultry made its appearance in California and other parts of the United States of America. Known by a variety of names such as Influenza, Canadian 'Flu, Infectious Bronchitis, and Laryngotracheitis, this disease, characterized by symptoms of a respiratory nature, was for many years confined principally to the North American continent, and little interest in the condition was displayed by workers in other parts of the world. Within the last few years, however, its presence has been detected in England and Germany, and it was with surprise and no little consternation that a clinically similar condition, subsequently proved to be identical with the American form, was discovered this year in New South Wales and a week or two later in Victoria.

When first seen in North America, infectious laryngotracheitis appeared as an acute infection of the respiratory tract of birds, frequently accompanied by a fairly high mortality rate. Since then, further investigations have shown that the disease varies very considerably from time to time and in different flocks, and all gradations from an acute and relatively fatal infection to a mild transient disease with an insignificant mortality rate may be seen.

The cause of this disease is a filter-passing virus, which is quite specific in its action, and can be identified by suitably devised laboratory tests. As far as is known, the disease is confined to fowls and is not transmissible to other domestic poultry, or wild birds. References are made in certain works to the occurrence of similar diseases in turkeys, ducks, and pigeons, but their identity with infectious laryngotracheitis has not yet been proved. In its acute form, the most pronounced symptom in an infected fowl is the manifestation of extreme respiratory distress. The bird elevates its head, extends the neck, and opens the mouth in an attempt to breathe. Not infrequently fits of coughing and sneezing may be exhibited, with the expectoration of blood-stained mucus from the windpipe. Sometimes the eyes and facial sinuses are involved, and a watery discharge from the eyes and nostrils appears. If death does not occur, the material in the windpipe, which at first consists of mucus containing varying amounts of blood, rapidly changes to a caseous or cheesy exudate. Not infrequently the windpipe may become completely occluded, and the resulting obstruction to the passage of air causes the sudden death of the bird through suffocation.

Post-mortem examination of a typical, acute case of this disease shows that the lesions are confined to the upper respiratory tract. The mucous lining of the windpipe shows inflammatory changes, the larynx may be swollen, and varying amounts of exudate, either mucinous or caseous and blood-stained, are found in the windpipe even as far down as the bronchial tubes. Although the causal virus may be isolated from the spleen and liver of affected birds, these organs show no obvious changes.

The symptoms and lesions of laryngotracheitis vary greatly in different birds and in different flocks. All grades of infection may be seen from the acute form described above to the form where, apart from some slight injection of the laryngeal mucosa and a slight excess of mucus, no abnormality is found at post-mortem, and the affected bird reveals no evidence of ill health during life. Sometimes the only indication of the presence of the disease is given by an occasional sudden death in an apparently healthy flock of birds. Post-mortem examination reveals a plug of yellowish-white cheesy material wedged in the entrance to the larynx, causing asphyxia. Occasionally birds in such a flock may show some mouth breathing, and if carefully inspected, especially at night, they may exhibit an abnormal incidence of coughing and sneezing.

Fowl showing acute symptoms of the disease.

There appears to be no doubt that the condition popularly called "roup" by the poultry farmer is in some instances due to the virus of laryngotracheitis. For many years there has been considerable confusion regarding the identity of the respiratory diseases of fowls. For instance, the virus of fowl pox is capable of producing changes in the respiratory tract similar to those caused by infectious laryngotracheitis, and judged on the symptoms and post-mortem signs shown by affected birds, these two diseases are sometimes indistinguishable. Recently Dr. F. M. Burnet, of the Melbourne Hospital, has devised a method whereby some of the virus diseases of birds may be accurately identified, and it was mainly due to his assistance that the presence of infectious laryngotracheitis in Australia was confirmed.

Until the early part of this year, the presence of this virus in Australia had not been recognized. An investigation by Dr. Seddon, Director of the Veterinary Research Station at Glenfield, N.S.W., of several outbreaks of a serious disease of poultry which occurred in New South Wales in the autumn of 1935 revealed the presence of an acute respiratory condition, indistinguishable clinically from the acute form of infectious laryngotracheitis, and experimental research subsequently confirmed its identity. Prompt measures were taken by the authorities in that State to limit this acute disease to the infected properties. Shortly after the disease had been identified in New South Wales, the virus was discovered in two fowls which died suddenly on a poultry farm in Victoria. A careful examination of the remaining birds on this farm, however, failed to reveal any evidence of an acute infectious disease, and from the history of the flock supplied by the owner, it appeared probable that the disease had been present on this property for a number of years, in a very mild form, the majority of infected fowls showing no symptoms of the disease, or recovering spontaneously after a transient indisposition. A survey of a number of poultry farms was then made, and a blood examination of fowls on these properties showed quite conclusively that this complaint has been present in Victoria for some time, but as far as is known, the acute type of the disease with a relatively high mortality rate has not yet been seen in this State.

The reasons why an infectious disease of this nature suddenly assumes an acute and serious form are at the present time unknown. It is probable that the mild form has been endemic in the flocks of New South Wales for some years and under the influence of factors which are at present not understood the virus has become stronger or more virulent, resulting in the serious outbreaks referred to above. The possibility of a similar increase in virulence of the disease occurring in Victoria must be kept in mind, and poultry farmers are urged to notify authorities immediately there are any outbreaks of an acute respiratory disease among their flocks.

Owing to the widespread nature of the disease, it is doubtful whether any measures for its control and eradication would be effective, or even justified, as long as it retains its mild form. Should the virulence increase, and the infection prove serious in its effects, then it may be necessary to adopt stringent control methods for the protection of the poultry industry in this State.

Manurial Trials on Potatoes

Results for 1934-35

By J. T. Ramsay, Potato Expert.

THE phenomenally heavy rains during the past summer had a disastrous effect on the potato crop in certain parts of the State, and particularly on the swamp lands of Gippsland, when practically a total loss of the crop was suffered. It is estimated that the floods destroyed fully 10,000 acres, or approximately one-fifth of the total average area under potatoes in the State. Other districts, particularly the central highlands suffered severely from Irish blight (*Phytophthora infestans*). The western portion of Victoria, on the other hand, was comparatively free from trouble from either of these causes.

Experimental plots at Beech Forest. Left, Unmanured; Right, Treated with 6 cwt. superphosphate and 1 cwt. ammonium sulphate per acre.

BEECH FOREST.

Beech Forest was one of the districts to suffer least from the extraordinary seasonal conditions, and in the manurial trials carried out there, remarkably high increases were obtained compared with the returns from the unmanured check plots. Field trials in the manuring of the potato crop have been conducted in this district for the past four years, and the soil there—mostly a friable dark clay loam—has proved most responsive to artificial manures. Owing to the high rainfall at this centre, the quantities of superphosphate used per acre were from 6 to 9 cwt. per acre, singly and in combination with nitrogenous and potassic fertilizers. The figures given below illustrate the effect of the various manurial combinations for the year just ended, and also for the period of the tests. The average for the four years shows a progressive increase from the lightest to the heaviest dressings, with the exception of the mixture containing potash. For some reason not apparent at present, potash has failed to justify its inclusion as a manure for potatoes in the bulk of the soils devoted to potato production in Victoria. The rates of application of sulphate of ammonia range from 1 cwt. to 2 cwt. per acre.

TABLE I.—POTATO MANURIAL TESTS, BEECH FOREST, 1934-35.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 6 cwt. ..	4 10	2 7	109
Super., 9 cwt. ..	4 7	2 4	102
Super., 6 cwt. + amm. sulp., 1 cwt. ..	5 19	3 16	176
Super., 6 cwt. + amm. sulp., 2 cwt. ..	7 5	5 2	237
Super., 9 cwt. + amm. sulp., 1 cwt. ..	7 16	5 13	263
Super., 9 cwt. + amm. sulp., 2 cwt. ..	7 15	5 12	260
Super., 6 cwt. + amm. sulp., 1 cwt., pot. sulp., 1 cwt. ..	6 16	4 13	214
No manure	2 3	..	..

TABLE II.—AVERAGE RESULTS, BEECH FOREST, FOR FOUR YEARS, 1931-32 TO 1934-35.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 6 cwt.	5 18	44
Super., 9 cwt.	6 10	58
Super., 6 cwt. + amm. sulp., 1 cwt.	8 12	109
Super., 6 cwt. + amm. sulp., 2 cwt.	9 0	119
Super., 9 cwt. + amm. sulp., 1 cwt.	9 2	122
Super., 9 cwt. + amm. sulp., 2 cwt.	10 0	144
Super., 6 cwt. + amm. sulp., 1 cwt., pot. sulp., 1 cwt.	8 0	95
No manure	4 2	..

Up to date in this district the heaviest dressings of super. and ammonia have shown the best results as far as weight of crop is concerned, though the greatest increase per unit of fertilizer has been given by the "6 + 1" mixture. So far, however, the tests show that the heavier dressing is economically sound. The outstanding feature of the Beech Forest results is the great increase in yield from the use of fertilizers as compared with that from the unmanured plots.

KOROIT.

During the past season the volcanic soil of the Koroit district, which is among the richest in the State, again showed material increases from the use of artificial fertilizers. The range of increases was from 21 per cent. to 57 per cent., the latter being the effect of a dressing of 3 cwt. super. and 2 cwt. ammonium sulphate per acre. Over the five-year period during which tests have been carried out in this district, the "3 + 1" super. and ammonia dressing has given the highest average increase —34 per cent. The "3 + 2" mixture, however, has been tried only in the last two years.

A selected crop of "Up to Dates" at Beech Forest.

It is surprising that such striking returns are obtained from the use of fertilizers on soils so rich naturally as those at Koroit, while other soils much poorer fail to show anything like the same response.

Details of the returns are shown in Tables III. and IV.

TABLE III.—POTATO MANURIAL TESTS, KOROIT, 1934-35.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	8 6	1 18	29
Super., 3 cwt. ..	8 11	2 3	33
Super., 4 cwt. ..	8 14	2 6	36
No manure	6 8	..	..
Super., 3 cwt. + sulp. amm., 1 cwt. ..	9 13	3 5	51
Super., 3 cwt. + sulp. amm., 2 cwt. ..	10 1	3 13	57
Basic super., 3 cwt. ..	7 15	1 7	21

TABLE IV.—AVERAGE RESULTS, KOROIT, FOR SEVEN YEARS, 1928-29 TO 1934-35.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	7 9	23
Super., 3 cwt.	7 11	24
Super., 4 cwt.	7 11	24
No manure	6 1	..
Super., 3 cwt. + sulp. amm., 1 cwt.	8 3	34
Super., 3 cwt. + sulp. amm., 2 cwt.	10 10	32*
Basic super., 3 cwt.	7 0	15

* 2 years only.

WHEATSHEAF.

The year's results from trials conducted on the red volcanic loam at Wheatsheaf, 6 miles from Daylesford, again illustrate the advisability of judicious manuring. Substantial increases were obtained from all manures, varying from 40 per cent. to 110·6 per cent. over the untreated lots. The greatest improvement in yield was gained from the "3 + 1" application of super. and ammonium, which increased the crop by 4 tons 3 cwt. per acre.

This mixture has given remarkably consistent results at Wheatsheaf during the past six years. All manures, however, gave highly significant increases in yield.

TABLE V.—POTATO MANURIAL TESTS, WHEATSHEAF, 1934-35.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	5 5	1 10	40
Super., 3 cwt. ..	5 18	2 3	57
Super., 4 cwt. ..	5 13	1 18	51
No manure	3 15	..	..
Super., 3 cwt. + sulp. amm., 1 cwt. ..	7 18	4 3	111
Super., 3 cwt. + sulp. amm., 2 cwt. ..	7 7	3 12	96
Basic super., 3 cwt. ..	5 9	1 14	45

TABLE VI.—AVERAGE RESULTS, WHEATSHEAF, FOR SEVEN YEARS, 1928-29 TO 1934-35.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	4 15	35
Super., 3 cwt.	5 0	43
Super., 4 cwt.	5 4	48
No manure	3 10	..
Super., 3 cwt. + sulp. amm., 1 cwt.	6 6	80
Super., 3 cwt. + sulp. amm., 2 cwt.	7 6	68*
Basic super., 3 cwt.	4 6	23

* 3 years only.

TRENTHAM EAST.

Soils and climatic conditions at the Trentham East plots are very similar to those at Wheatsheaf, but the percentage response to the various manurial dressings is greater here than is the case at Wheatsheaf. The highest average increase over the currency of the tests has been given by the "3 + 1" dressing of super. and ammonium sulphate, which is easily the most beneficial and profitable manure tried at this centre.

The yields for last year, and the average returns over the past eight years are set out in Tables VII. and VIII.

TABLE VII.—POTATO MANURIAL TESTS, TRENTHAM EAST, 1934-35.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	8 10	1 10	21
Super., 3 cwt. ..	10 19	3 19	56
Super., 4 cwt. ..	9 14	2 14	39
No manure	7 0	..	..
Super., 3 cwt. + sulp. amm., 1 cwt. ..	11 17	4 17	69
Super., 3 cwt. + sulp. amm., 2 cwt. ..	12 3	5 3	73
Basic super., 3 cwt. ..	8 4	1 4	17

TABLE VIII.—AVERAGE RESULTS, TRENTHAM EAST, FOR EIGHT YEARS, 1927-28 TO 1934-35.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	5 3	56
Super., 3 cwt.	6 2	85
Super., 4 cwt.	5 15	74
No manure	3 6	..
Super., 3 cwt. + sulp. amm., 1 cwt.	6 17	107
Super., 3 cwt. + sulp. amm., 2 cwt.	8 1	100*
Basic super., 3 cwt.	4 18	49

* 3 years only.

An excellent crop of "Up to Dates" on new land.

MUSK.

At Musk the returns from the plots continue to be satisfactory. During the past season the increases in yield over "no manure" ranged from 40 per cent. to 95 per cent., the latter being obtained from the "3 + 2" dressing of super. and ammonium sulphate. This is another centre at which the heavier application of ammonium sulphate appears to be profitable. The average returns of the past seven years appear to demonstrate conclusively that 3 cwt. of superphosphate per acre is the maximum quantity which can be profitably applied

to the volcanic soils in the central and western parts of the State. The returns are shown in the accompanying tables:—

TABLE IX.—POTATO MANURIAL TESTS, MUSK, 1934-35.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	8 1	2 14	50
Super., 3 cwt. ..	8 14	3 7	63
Super., 4 cwt. ..	8 1	2 14	50
No manure	5 7	..	..
Super., 3 cwt. + sulp. amm., 1 cwt. ..	9 15	4 8	82
Super., 3 cwt. + sulp. amm., 2 cwt. ..	10 9	5 2	95
Basic super., 3 cwt. ..	7 10	2 3	40

TABLE X.—AVERAGE RESULTS, MUSK, FOR SEVEN YEARS, 1928-29 TO 1934-35.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	4 13	1 1	30
Super., 3 cwt. ..	5 1	1 9	40
Super., 4 cwt. ..	5 2	1 10	42
No manure	3 12	..	..
Super., 3 cwt. + sulp. amm., 1 cwt. ..	6 0	2 8	67
Super., 3 cwt. + sulp. amm., 2 cwt. ..	8 6	3 18	87*
Basic super., 3 cwt. ..	4 13	1 1	30

* 3 years only.

ROMSEY.

Although the soil at Romsey is not so rich as are some of the soils used for experimental work in other parts of the State, only moderate response to manuring has been obtained there during the seven years of the tests.

The manurial dressing showing the highest average increase over that period is the "3 + 1" mixture of super. and ammonium sulphate, though this has given only a slightly heavier yield than has 3 cwt. super. alone.

The improvement in yield on the average is so small that it does not seem to justify the added cost of applying the ammonium sulphate. Increasing the quantity of sulphate of ammonia to 2 cwt. per acre has not proved profitable.

The apparent discrepancy in the percentage figures relating to the 2 cwt. ammonium sulphate dressing in Table XII. is due to the fact that this quantity has been used for three years only, and the increase has been calculated in comparison with the "no manure" returns for the same years.

TABLE XI.—POTATO MANURIAL TESTS, 1934-35.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	8 6	2 6	38
Super., 3 cwt. ..	8 12	2 12	43
Super., 4 cwt. ..	7 14	1 14	28
No manure	6 0	..	..
Super., 3 cwt. + sulp. amm., 1 cwt. ..	8 12	2 12	43
Super., 3 cwt. + sulp. amm., 2 cwt. ..	8 6	2 6	38
Basic super., 3 cwt. ..	7 14	1 14	28

TABLE XII.—AVERAGE RESULTS, ROMSEY, FOR EIGHT YEARS, 1927-28 TO 1934-35.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	5 14	1 1	23
Super., 3 cwt. ..	6 4	1 11	33
Super., 4 cwt. ..	5 12	0 19	22
No manure	4 13	..	..
Super., 3 cwt. + sulp. amm., 1 cwt. ..	6 5	1 12	34
Super., 3 cwt. + sulp. amm., 2 cwt. ..	6 9	1 16	39*
Basic super., 3 cwt. ..	5 11	0 18	20

* 3 years only.

Export of Bacon Pigs

British Requirements

ACCORDING to a report received from the Commonwealth Veterinary Officer in London (Mr. R. H. Heywood), there has been isssued under the *British Agricultural Marketing Act* 1933, the draft of a scheme for organizing the production of bacon in Great Britain.

Mr. Heywood states that this has given rise to some concern on the part of curers, and importers of frozen pork for curing purposes, in that no provision appears to have been made for imported pork. Representations are being made by the Imported Meat Trade Association and others to the Ministry, and it is hoped that nothing will be done to hamper or restrict the growing business of manufacturing "Empire Bacon," which is the description given to the product cured in the United Kingdom from Australian and New Zealand pigs.

New Zealand has made the most remarkable progress in this respect in the last few years, but Australia has not been idle. A few years ago the shipments of bacon pigs from Australia were nil. Last year they amounted to some 40,000 cwt., and there are already indications that the 75,000 cwt. allotted for 1935 will be no more than sufficient.

The following is an extract from a letter received by Mr. Heywood from the managing director of the Empire Bacon Curing Company Limited, whose factory is at Newcastle-on-Tyne:—

> With regard to Australian baconers, we are using considerable quantities of these in our factory, but, as I mentioned to you, it is very unfortunate that almost every pig exported from Australia is scalded, and not singed. As far as quality goes the Victorian and New South Wales pigs are quite up to the New Zealand standard, but owing to the fact that they are not singed they suffer a discount of around ¼d. per lb., when shipped to this country.
>
> There are several areas in Great Britain where bacon from scaled pigs will not be taken at any price, and these include such populous districts as the Liverpool and Manchester areas, and the Bristol area. In most other districts a discount of 2s. to 4s. has to be taken on this type of bacon.
>
> As I mentioned to you when I was in Australia, I was in contact with a number of the factories, but found it very difficult to convince them that they would do better by installing a singeing plant. Most of them seem to take the attitude that, as far as their pigs for local consumption were concerned, a singeing plant was not necessary, and as for their export pigs they always got as good a price as other Australian shippers, and were, therefore, quite satisfied.
>
> A reliable singeing plant can be bought from the Continent for between £200 and £300 c.i.f. Australian ports, and the cost of such a machine would be rapidly recovered by the export of a few parcels of pigs. It is interesting to note that, at the moment, New Zealand baconer pigs are fetching around 5⅞d. *ex* store, with Australian baconers at about 5½d. These facts speak for themselves.
>
> If it is possible for you to influence any of the producers in Australia to go in for singeing, you will undoubtedly be performing a service for the industry in Australia. Our factory alone could comfortably take 50,000 Australian pigs, and if these were singed, we should be quite prepared to pay the same price for these as for New Zealand's.

Mr. Heywood adds that, in his opinion, the mere fact that they may be singed does not fully explain the premium enjoyed by New Zealand pigs. It is true that, in many cases, the Australian pig is in no way inferior, but by constant study, investigation, and trial, New Zealand has more or less standardized a suitable pig. Consequently, New Zealand pigs are more uniformly good, and, moreover, producers in New Zealand, by means of their organization, are at a considerable advantage in respect of a regular and established market.

The Currant Borer Moth

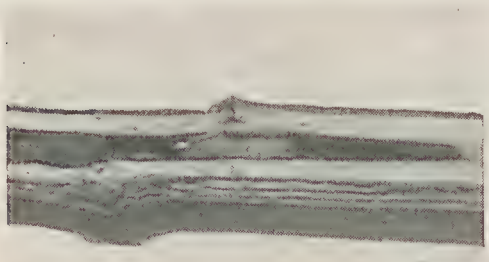
(*Aegeria tipuliformis Clerck*)

By R. T. M. Pescott, M.Agr.Sc., Entomologist.

THE currant borer moth, a native of Europe, again has made its appearance in those areas in Victoria where currants and berries are grown extensively. Growers in the Dandenong Ranges, in the Doncaster district, and in the suburban areas have reported losses from this insect. This pest was first reported from Victoria by Davey (1) in 1927, who recorded having collected specimens of the moths during October and November of 1926 in suburban gardens around Melbourne. Since that time, apparently, the pest has spread into other areas, and unless adequate precautions are taken while this pest is still in its infancy in this State, damage may become very severe. In Tasmania, it has been known since 1917 (2), and although originally found only in the northern part of the State, is now widespread over all parts of the island where berries and currants are grown.

Host Plants.—The currant borer moth, as the name suggests, is primarily a pest of currants; black currants being most commonly attacked, although both red and white currants are susceptible. Of the berries, the gooseberry and the raspberry are most commonly attacked.

Overseas records show that plants other than currants and berries may be attacked. Such plants include the Juniper (Juniperus), the Hazel (Corylus), the Spindle-tree (Euonymus), and the Black Elder (Sambucus).



Caterpillar feeding in red currant cane.

Pupal case protruding from the bark.

Nature of Damage.

The damage resulting from this insect is confined primarily to the canes of currants and the wood of berries. The larvae or caterpillars of the insect bore into the young canes, eating out the pith, then working downwards until finally they may reach to the roots. Such plants become very sickly, the foliage being dwarfed and yellowish, and the bushes are reduced greatly in productiveness.

During the winter months, it is not possible to distinguish affected canes in a bush. However, during early spring, definite signs are apparent. The new leaves produced on affected canes are yellowish and undersized, and such canes usually die within two or three weeks. The dead canes are frequently found with the tips broken off showing a burrow running the entire length of the cane, partly in the pith and partly in the wood.

Life History.

The currant borer moth overwinters in the form of a nearly full-grown larva, about half an inch long, inside the cane, and usually at

a short distance above the ground. With the commencement of plant growth in the spring, the larva becomes fully grown, and eating from the pith into the wood, cuts out a small hole nearly to the bark, and then pupates.

During the months of October, November, and December, the adult moth appears after the chrysalis has forced itself through the hole near the bark. The empty pupal case, which is a light yellowish-brown in colour, is frequently to be found protruding from the bark. The perfect moth is about half an inch in length with a wing spread of about three-quarters of an inch. The abdomen is metallic black, with a purplish sheen, and is banded with yellow stripes. At the tail end of the body is a fan-shaped mass of scales, black in colour. The wings are quite unlike those of most moths in that they are transparent, the scales being almost entirely absent. Owing to this transparent nature of the wings, this moth is frequently not recognized as such, being more commonly considered by growers to be a wasp. Such is not the case.

The adult currant borer moth.
[After Herrick.

The eggs, numbering from 20 to 60, are laid by the females in favorable spots on the bushes, such places usually being on young wood close to the buds. These eggs hatch, as a rule, within a fortnight, and the young larva immediately proceeds to bore into the wood. On reaching the pith, it commences a general downward movement, in extreme cases finally

A currant bush attacked by the borer.
[After Nicholls.

reaching the region of the roots. When fully grown, the larva measures about half an inch in length, is creamy white in colour, with a shining brown head. Overwintering takes place in the cane. There is only one generation per year.

Control.

Owing to the fact that the larva spends the whole of its life in the pith and wood of the canes, it is not possible to control this pest by spraying methods. Control measures therefore consist in the cutting out at ground level, in early spring (before October), of all canes and twigs showing the presence of yellowish undersized leaves with general dying back symptoms. This should be done in early spring (before October), and the canes and twigs must be destroyed immediately by fire.

References.

1. Davey, H. W. The Currant Borer. J. Dept. Agr., Victoria, xxv., p. 39. 1927.
2. Nicholls, H. M. The Currant Borer. Tasmania Bull., 69. 1922.

Grading and Packing of Cherries

By Basil Krone, Fruit Packing Instructor

IF the Victorian cherry market is to be developed on sound lines, it is essential that suitable methods of harvesting, grading, packing, and marketing be adopted. The first steps in successful marketing of this luscious fruit are careful harvesting and handling, as the cherry is particularly susceptible to the slightest injury. Although the market requires hard, firm cherries, the fruit should not be harvested until it is fully developed and has reached that stage of maturity (seemingly unripe), which will ensure the completion of the ripening process.

Grading.

The grading of cherries should be carried out along the following lines:—Classify the fruit by two grades, viz., "Extra Fancy" and "Fancy" according to market requirements. In some instances it may be more profitable to mix the two grades and market as "Fancy." This practice frequently is adopted with success by citrus, apple, and pear growers.

There are seasons when the quality of the cherry crop is above the average. In addition, there is always an excellent market for specially selected cherries.

"Extra Fancy" Grade.—

(*a*) Black varieties should be coloured dark red or black.

(*b*) White varieties should be coloured yellow over the whole surface with red flush.

(*c*) Size.—Each cherry should measure not less than $\frac{7}{8}$ inch in diameter.

"Fancy" Grade.—

(*a*) Black varieties should have not less than three-quarters of the surface coloured.

(*b*) White varieties should have not less than three-quarters of the surface coloured.

(*c*) Size.—Each cherry should measure not less than 11-16ths of an inch in diameter.

All fruit should be free from blemish, cracks, and malformation; fully developed, with stalks intact.

Fig. 1.—The 12 lb. case opened for inspection, showing the layer of cherries packed on the original bottom of the box.

White lining paper should be used in all instances, except where a special grade, such as "Extra Fancy" is desired. In such instances a coloured lining paper might be used as a distinguishing mark.

In exceptional seasons quantities of cherries are produced, which would not comply with the above standards. This fruit should be disposed of in containers other than the 12-lb. cherry box which denotes a high class article.

Packing.

Packing the cherry is a simple operation, nevertheless care is necessary. The packer must remember that the bottom of the box when finished ultimately will become the top, therefore after lining the box with clean white lining paper, the cherries should be lifted by the stalks direct from the picking box or bucket, and packed in rows on the bottom of the box, drawing all of the stalks upwards. The rest of the cherries are simply filled in, but not indiscriminately; they are handled by the stalks and filled to a height slightly above the top of the case. The contents are gently shaken until the lid can be easily nailed. The box is then turned over, and branded in such a manner that the buyer will not be in doubt regarding the lid. Fig. 1. illustrates a 12-lb. box of cherries open for inspection upon arrival at the market.

The case recommended for universal use is the "$\frac{1}{4}$ bushel," now known as the "12-lb.

(*Continued on page 506.*)

The Green Peach Aphid

Further Observations

By Keighley M. Ward, M.Agr.Sc., Assistant Entomologist

EXTENSIVE orchard and laboratory trials, begun in 1930 and conducted over a period of five years, have shown that the Green Peach Aphid (*Myzus persicae,* Sulz.) can be controlled under commercial conditions by employing a suitable ovicidal spray during the dormant period of peach trees. The control of the insect by this means is possible because in Victoria the species passes through an egg stage on peach trees in the winter, and these eggs constitute the source of spring infestation. Much of the work on the insect already has been reported in the February, March, and May, 1934, issues of this *Journal.*

1934 Spraying Tests.

With the twofold object of confirming results obtained in previous work, and of demonstrating to peach-growers the efficacy of winter spraying as a means of controlling the aphid, it was decided to carry out further tests during 1934. This decision was reached mainly because it was anticipated that the insect would be unusually abundant during the 1934 spring, as a result of a heavy deposition of the winter eggs on peach trees during the previous autumn.

The tests were carried out in the peach orchards of Messrs. W. Young, Ardmona, and Bedford Bros., at Kyabram. In each case the trees treated were of a variety which produced a late-maturing type of canning peach (Healesville and Thiele's clingstones). The spray materials were employed as ovicides, since the destruction of the eggs before they hatch is considered to be the soundest method of preventing infestation of the trees in spring. The treatments consisted of (i) 3 per cent. tar distillate wash; (ii) 2 per cent. tar distillate wash; (iii) 5 per cent. red oil; and (iv) 10 per cent. lime-sulphur. An appropriate number of plots was left unsprayed.

Prior to the application of the spray materials, a survey of each plot was made (as was done in the previous orchard trials) to ascertain approximately the numbers of aphid eggs present on the trees. This examination showed that at the Ardmona orchard the infestation of eggs was light (average three eggs per twig), while at Kyabram the infestation was relatively heavy (average 25 eggs per twig). The figures appearing in the last column of Table I. represent approximately the average number of aphid eggs per twig on each group of plots receiving the same treatment. They are based on counts of the eggs made on each of a number of twigs 12 to 15 inches in length, taken from each of the eight trees in a plot. The sprays were applied under favorable conditions on 3rd July at Ardmona, and on 12th July at Kyabram.

The spring of 1934 proved very favorable to the survival and increase of the aphid in the

TABLE I.—GREEN PEACH APHID OVICIDE TESTS IN THE GOULBURN VALLEY, 1934.

Locality.	Treatment.	Infestation. (Per cent.)	Average Number of Eggs per Twig at Spraying.
Ardmona	Tar distillate—Brand I.—3 per cent.	2·0	3·7
	Tar distillate—Brand I.—2 per cent.	4·8	2·5
	Tar distillate—Brand II.—3 per cent. ..	0·2	3·3
	Red Oil—5 per cent.	8·6	3·5
	Lime-sulphur—10 per cent.	19·4	1·5
	Unsprayed	50·0	1·0
	Standard error ..	7·9	..
Kyabram	Tar distillate—Brand I.—3 per cent.	4·7	44
	Tar distillate—Brand I.—2 per cent.	26·9	18
	Red Oil—5 per cent. ..	35·2	24
	Lime-sulphur—10 per cent.	44·9	25
	Unsprayed	89·0	14
	Standard error ..	6·2	..

An unsprayed peach tree in the Goulburn Valley infested with green peach aphid.

Goulburn Valley, with the result that a severe outbreak of the pest occurred at many of those peach orchards where suitable ovicides had not been used during the winter. Thus, conditions were suitable for a fairly severe practical test of the insecticides involved. The experimental trees were examined for the final results late in spring, when on each plot counts were made to determine the percentage of twigs which were infested by the aphid. The results are presented in a summarized form in Table I. The figures showing infestation after each spray treatment have been subjected to the ordinary statistical analyses. The large standard error in each case indicates the great variation which occurs in this type of experiment. The observations on infestation were made by Messrs. W. Nunn and V. Lawrey, orchard supervisors.

Considering the Ardmona results, and comparing the figures from sprayed and unsprayed trees, it will be seen that each of the spray materials was responsible for a significant reduction in infestation. There is no significant difference, however, between any of the individual spray materials with regard to the degree of control exercised.

At the Kyabram centre, more satisfactory or significant results were obtained. All of the sprays brought about a significant decrease in infestation, but commercially satisfactory control of the insect was given only by the tar distillate wash used at 3 per cent. strength. Tar distillate at 2 per cent. strength gave better control than 10 per cent. lime-sulphur, but in both these cases, and also in the case of red oil, the degree of control cannot be considered as satisfactory.

While the red oil and lime-sulphur, used in these tests as ovicides did not give satisfactory control of the aphid, it is felt that further tests of these materials may be desirable. Various brands of lime-sulphur differ considerably in their polysulphide sulphur content, which may influence their insecticidal efficiency. Certain types of this material have shown evidence of being highly toxic to the aphid eggs. It may therefore be possible to find a type of

Infestation by green peach aphid was prevented in this tree by the use of a tar distillate winter wash.

lime-sulphur which would serve firstly as an ovicide against the aphid eggs, and secondly as a fungicide against peach tree diseases, such as leaf curl. With regard to the use of red oil against the green peach aphid, it has been claimed that better results can be obtained when it is employed as a contact insecticide to destroy the young aphids soon after hatching and before they have been able to become established on the foliage of the trees. In the experiments reported in this paper, red oil was used only as an ovicide.

A glance at Table I. shows that the figures obtained from the Kyabram plots are markedly higher than those from Ardmona. This difference is attributable to the fact that the *initial infestation,* which resulted from the hatching of the eggs at the beginning of the season, was much higher at Kyabram than at Ardmona. From a comparison of the figures showing the numbers of eggs on the trees at the two centres, this situation was to be expected. An important point which emerges from the Ardmona figures is that a severe spring infestation by the aphid can occur on unsprayed trees in spite of the fact that only a few eggs are to be found on the trees during the winter. In other words, provided that favorable spring weather occurs for the development of the aphid, a severe outbreak can arise in any particular orchard from a low initial infestation. At the Ardmona orchard the plots of unsprayed trees showed an average infestation of 50 per cent., but many of the individual trees in these plots showed 100 per cent. infestation.

In general, these tests confirm results obtained in previous work, and they show that infestation by the green peach aphid can be prevented by the use of a suitable ovicide in winter. With regard to the effect of tar distillate wash on the trees themselves, it can only be stated that experimental trees have been sprayed for three years in succession at Ardmona, and for five years in succession at Burnley, without noticeable injury having occurred to the trees.

As a result of the experimental work which has been carried out against the green peach aphid, the following general recommendations can be made:—For the control of this pest on peach and nectarine trees, use tar distillate wash at a strength of 3 per cent., and apply the spray between the middle of June and the second week in July. The degree of success achieved by this method will depend mainly upon obtaining *complete cover* of the trees by the spray. The eggs of the aphid are likely to be laid on almost any part of the tree, but they occur mainly behind the leaf and fruit buds on the twigs or laterals. If a single egg escapes the spray and hatches, the potential number of aphids which can arise in four generations is 1,750,000.

Factors Causing Outbreaks.

Outbreaks of the green peach aphid occur in Victorian peach orchards at irregular intervals of several years. General observations in recent years have suggested that each outbreak is associated with the occurrence of certain climatic conditions. An attempt has been made, therefore, to find what relation, if any, exists between the occasional abnormal abundance of the insect and certain elements of climate.

Eggs of green peach aphid around dormant peach bud.

Unfortunately, reliable records of outbreaks in Victoria are few, but in the past eight years three outbreaks in the Goulburn Valley area have come directly under the writer's notice. They occurred during the years 1928, 1932, and 1934. The 1928 outbreak was severe, and resulted in heavy losses of crop, amounting to 75 per cent. in individual cases; in 1932, a moderate general infestation occurred with only slight losses of crop; while the 1934 outbreak was more severe than that of 1932, but its effect was masked to a certain extent by the fact that a considerable amount of spray-

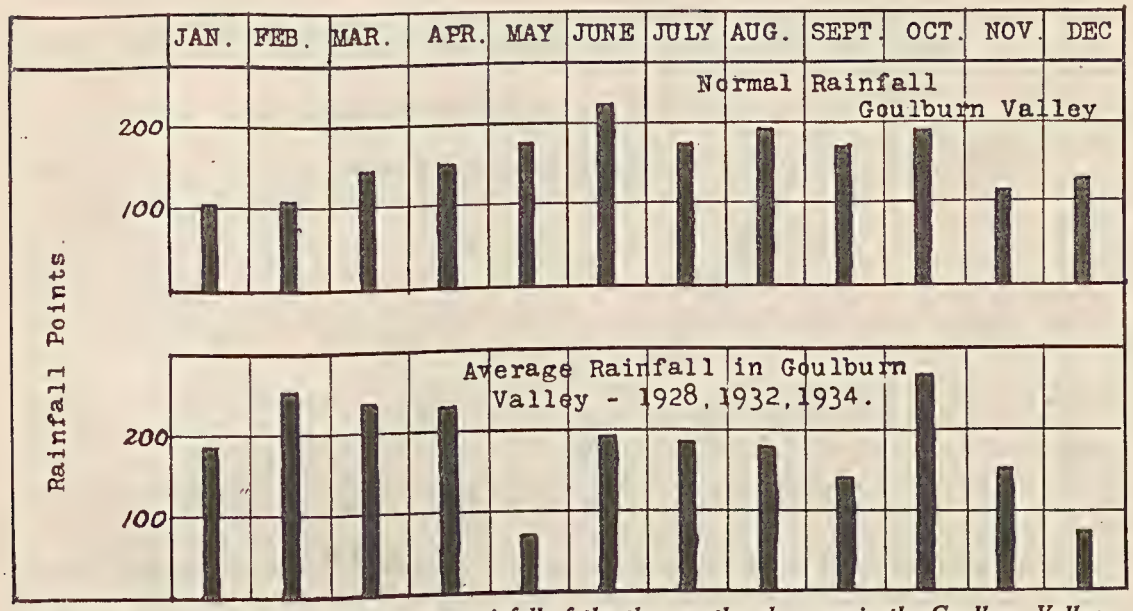


Fig. 1.—Normal rainfall, and the average rainfall of the three outbreak years in the Goulburn Valley.

ing with effective ovicides had prevented the infestation of many peach orchards. It is considered that the available data do not provide a sufficient basis for final conclusions, but the existence of a relationship between the abundance of the aphid and certain climatic conditions is indicated.

Meteorological data have been taken for several years in the Goulburn Valley, and graphs of normal temperature, humidity, and rainfall have been constructed from records collected over long periods of years. For comparison with these graphs others have been drawn from records taken from the same towns, but only the outbreak years (1928, 1932, and 1934) have been taken into account.

From the normal curve of yearly *rainfall*, which is shown in Fig. 1, it is seen that most of the rain falls during the colder months of the year, while the lowest rainfall occurs in the summer months (December, January, and February). During the outbreak years, however, a very different and abnormal distribution is evident, the wettest months being January, February, March, and April, with an unusually high rainfall in October. The abnormal, high rainfall in the summer and autumn months is responsible for the abundant growth, in and near peach orchards, of certain plants which constitute the summer and early autumn food supply of the aphids. In spite of the probable inhibitory effect of high

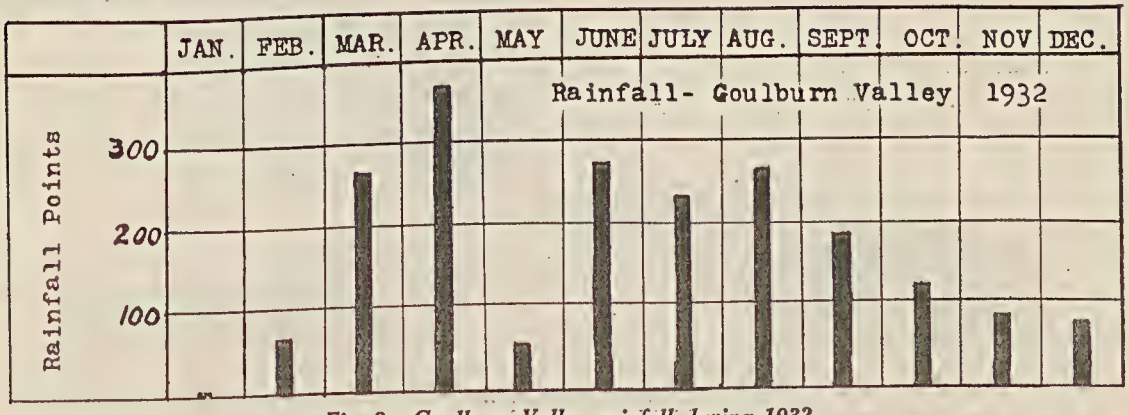


Fig. 2.—Goulburn Valley rainfall during 1932.

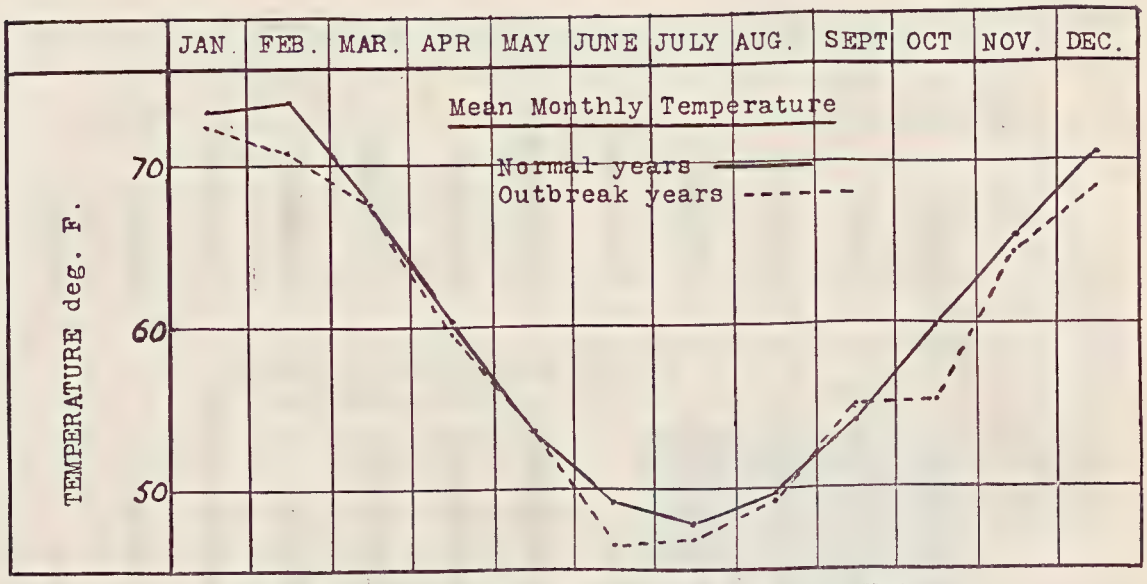


Fig. 3.—The mean monthly temperatures in the Goulburn Valley.

summer temperatures on the insect, an ample food supply in late summer and early autumn would tend to produce a large population of aphids by mid-autumn, when they begin to migrate to peach trees for egg-laying. (See Fig. 4.) Under these conditions a heavy autumn migration might be expected, with a resultant heavy deposition of winter eggs on the trees. Normally, these eggs would hatch, and provide a high initial population of aphids in spring, thus increasing the possibility of a severe outbreak of the insect.

Rainfall in the year 1932 differed from that in the two other outbreak years. (See Fig. 2.) This difference was in the amount of summer rain which, for December (1931) and January and February (1932) was 68 per cent. below normal. In this abnormally dry summer a high proportion of the secondary food plants of the insect dried out, and the oversummering population of aphids was reduced to a very low level. There was in that year only a slight autumn migration to peach trees, and comparatively few winter eggs were deposited. Consequently, there was a low initial infestation by the aphid in spring, but temperature conditions in September and October apparently favoured the increase and survival of the insect, so that a moderately heavy infestation was built up in Goulburn Valley peach orchards.

Now consider mean monthly *temperatures* which are shown in Fig. 3. The normal temperature curve falls regularly to mid-winter, and then rises again gradually during spring and summer. The curve for outbreak years differs markedly from the normal curve in that the spring rise is not regular, but is interrupted in September and October. The average for September tends to be above normal, and that for October is below normal. The result is that the mean temperature for both September and October is about the same at 55° F. (See Fig. 3.) It is evident that these two months are of considerable importance in the insects' life-cycle, for during this period the aphid becomes established on the growing foliage of the trees, reproduces at a high rate, and towards the end of October reaches the peak of infestation. It would appear that the temperature conditions required for a high rate of multiplication and survival of the aphid are such as are indicated for September and October in the curve for outbreak years. (Fig. 3.) The occurrence of these conditions over a period of two months (as occurs in outbreak years) would permit the uninterrupted building up of an enormous population of the insect.

A detailed examination has been made of the *maximum temperatures* occurring during September and October of the years 1927 to 1934. Observations made from this point of view are summarized in Table 2, and the figures are based on records taken from Dookie and Shepparton.

TABLE II.—MAXIMUM TEMPERATURES IN THE GOULBURN VALLEY DURING SEPTEMBER AND OCTOBER, 1927 TO 1934.

Years.	Mean Maximum Temperature.		Highest Temperature.		Number of Days above 70° F.		Number of Days above 77° F.		Number of Successive Days when Average Temperature above 77° F.
	Sept.	Oct.	Sept.	Oct.	Sept.	Oct.	Sept.	Oct.	
Normal—1927, 1929, 1930, 1931, 1933 ..	64·3	71·4	75·2	90·1	3·9	17	0·2	7·5	7·4 (79·3° F.)
Outbreak—1928, 1932, 1934 (average) ..	65·5	66·1	85·2	80·1	7·3	6	0·8	0·8	0·8 (81·9° F.)

During the outbreak years the October temperature exceeds 77° F. on an average of less than one day, while during the years in which no outbreak occurs this temperature is exceeded on an average of 7.5 days. Further, there is a marked difference between outbreak and non-outbreak years in the number of *successive* days during which the maximum October temperature averages more than 77° F., being 0.8 day and 7.4 days respectively. These figures indicate that the occurrence of a high maximum temperature on a number of succeeding days in spring of non-outbreak years probably is a factor which limits certain activities of the insect. This factor most likely causes the inhibition of reproduction and development, and even may be responsible for the death of great numbers of the aphids. The absence of these high temperature conditions in outbreak years probably permits the insects to breed without interruption, and results in a high survival rate.

These conclusions are supported by the results of experiments made by Weed (1) on the breeding of *Myzus persicae* at various constant temperatures. His results show that as the temperature approaches 82.4° F. (85 per cent. humidity), there is a decrease in both reproduction and longevity. At this temperature (i) the reproductive period is shortened by 58 per cent. of that at the optimum temperature, (ii) the total number of young produced is lowered by 68 per cent., and (iii) the total length of life of the insect is decreased by 31 per cent. De Jong (2) states that the optimum temperature for *M. persicae* is about 77° F. He adds that if this is exceeded for even a few hours reproduction is checked, its effect being most marked in the immature stages of the insect; the general effect is to cause a shortening of life and the production of less progeny.

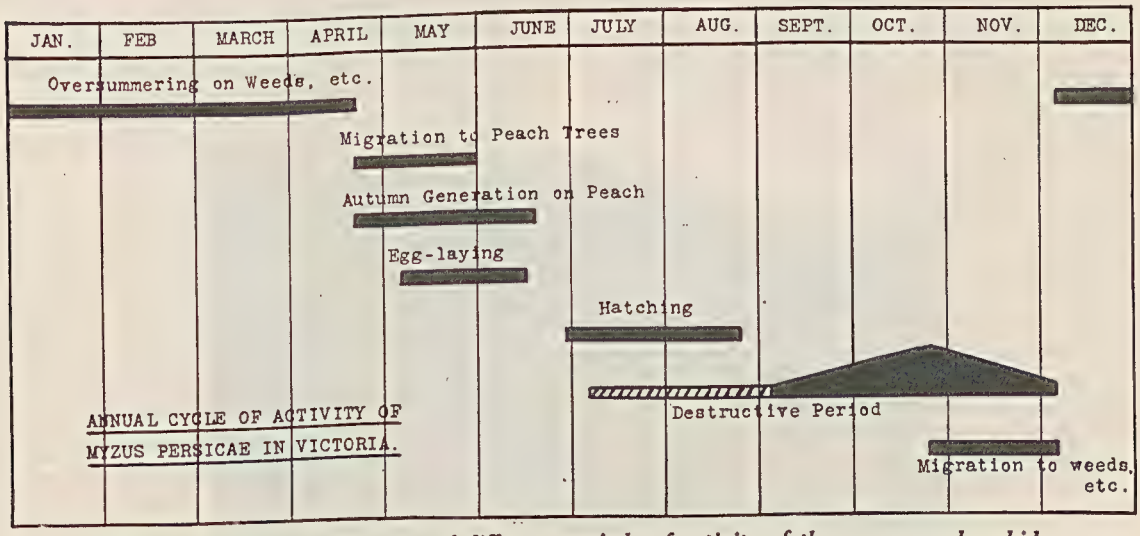


Fig. 4.—Showing the duration of different periods of activity of the green peach aphid.

Discussion.

Considering the data as a whole, it would appear that outbreaks of the green peach aphid in the Goulburn Valley are associated with (i) high summer rainfall, which stimulates the growth of certain plants that provide food for the aphid in summer and early autumn, and (ii) spring conditions of temperature which remain approximately the same through September and October, and which rarely rise above the temperature at which activities of the insect are inhibited. The data suggest that the most severe outbreaks are likely to occur in those years in which these two sets of conditions follow each other. Summer conditions which are unfavorable for the development of a large migrating population in autumn apparently may be compensated for by the occurrence of favorable spring temperatures which may result in at least a moderate outbreak of the insect. Under these conditions the outbreak would have arisen from a low initial population.

From the data examined it appears that a potential outbreak year is one in which an unusually high summer rainfall occurs, its probable effect being to give rise to an abundant summer and autumn food supply for the aphid, whereby a large migrating population can develop prior to the laying of winter eggs. The most important factor limiting an outbreak is apparently temperature conditions during the months of September and October.

References.

(1) Weed, A.—*Jnl. Econ. Ent.*, Vol. 20, No. 1, 1927.
(2) De Jong,—*Rev. App. Ent.*, XVII., Part II., Nov., 1929.

Grading and Packing of Cherries

(*Continued from page* 499.)

cherry-box." It is gratifying to notice the increasing popularity of this box, and its more general adoption. The dimensions and specifications of timber required for manufacturing the 12-lb. cherry box, which is 13¾ inches long, 10⅛ inches wide, and 4 inches deep (inside measurements), are as follow:—

Ends—2 pieces, 10⅛ inches long, 4 inches wide, ½ inch thick.
Sides—2 pieces, 14¾ inches long, 4 inches wide, 5-16 inch thick.
Lids and Bottoms—4 pieces, 14¾ inches long, 5¼ inches wide, ¼ inch thick.
(Cubical content of box—556⅞ cubic inches.)

Salient Points for the Packer.

1. Avoid harvesting or packing wet cherries. Blemished and split cherries are chiefly due to wet conditions.

2. Handle cherries by the stalk carefully, and not by the fruit.

3. It pays to grade cherries for quality.

4. Stalkless cherries in a pack are frequently the cause of patches of decayed fruit in a box; reject all such.

5. The 12-lb. cherry box only, should be used for high class cherries.

Causes of the Short Victorian Vintage for 1935

Part II.—Downy Mildew and The Preparation of Fungicides.

By D. G. Quinn, Special Horticultural Instructor

The Influence of Black Spot, frost and the unusual seasonal rainfall as factors contributing to the short Victorian vintage for 1935 were discussed in the August issue of this Journal.

IN many vineyards, from mid-October of last year onwards, downy mildew, as well as black spot, could be observed at work on the same vine. The particularly late and wet spring no doubt made this feature so marked, and many growers complained that the standard Bordeaux treatment for downy mildew had not proved as effective as usual. It was pointed out in the previous article that black spot activity begins much earlier in the spring than downy mildew, and it is quite possible that much of the bunch damage which was evident at the flowering period may, in many cases, have been due to the black spot fungus, which was well established within the tissues of the plant and not affected, even when an early spray for downy mildew was given in mid-October before the flowering period of the vine. There is, therefore, room for considerable thought as to whether the main loss of crop, in many places, was due to the ravages of downy mildew or black spot, or both.

Although it is an easy matter to distinguish between these two diseases later in the season, it is not so simple in their earliest stages of development, and in all cases where the setting of the fruit was damaged by disease, it will be advisable for the grower to analyse the position from this aspect. If signs of black spot can be recalled, or were noted anywhere when pruning, spraying operations (see previous article) should be started much earlier than where a development of downy mildew alone was experienced.

Downy mildew, however, was present in most non-irrigated vineyards in the State, and, as a result, in most cases the yields were certainly diminished seriously, even where the growers sprayed liberally. As spraying results generally were not entirely satisfactory, it is desirable to review the nature of the disease and the steps necessary to combat it, in the hope of improving on the relatively faulty results given by the spraying programme of last season.

Life History.

Towards the end of the summer, the fungus inducing downy mildew develops thick-walled winter spores within the tissues of the leaves. With the fall of the leaves, and their subsequent decay, these winter spores lie scattered all over the soil of the vineyard, and there is no simple means of killing them at this stage. It has even been found that, if the infected foliage is fed off with stock, these spores will pass through the digestive organs of the animal without suffering injury.

The spores lie dormant until the wet weather and rising temperatures of mid-spring cause them to germinate and release their contents —termed zoospores. These zoospores are delicate oval bodies which are provided with "cilia" or vibrating tails that enable them to move about in a film of water. Some are splashed by rain on to the vine, and these move about the wet foliage until they come in contact with a breathing pore of a young cane, leaf, or fruit, as the case may be, when they throw out a germ tube, which passes via the stoma or breathing pore into the internal tissues of the plant. From then on, the fungus develops internally, and cannot be reached by any spray which does not destroy the annual foliage. The only time, therefore, when the fungus is assailable is at that period when the active zoospores are floating about in the film of moisture which hangs to the foliage during wet weather.

Once the leaf has been entered the germ tube continues its growth, and gives rise to a network of filament termed the mycelium, and within seven to eight days after infection this

Grey rot or bunch mildew—note characteristic white down.
[After Ravaz.]

causes the appearance of the characteristic pale "oil spot" on the leaf. The fungus then remains practically dormant in the oil spot stage, doing comparatively little harm, until damp weather occurs, when summer spores will be thrown out in great numbers on the underside of the leaf. This occurrence can be noted with the naked eye, the spores are massed together, and look like a patch of glistening salt hanging to the underside of the oil spot. These spores fall upon the upper sides of lower leaves, or are carried by the wind to infest other areas. Owing to the amazing number of summer spores liberated, and the fact that they are light enough to be distributed by the wind, this disease spreads with remarkable rapidity under suitable conditions. The spores will not germinate until they have been wet for some hours, and then they do not germinate like the spores of most other fungi, but by releasing zoospores or animal-like spores capable of movement in water.

The mycelial growth arising from a single spore does comparatively little harm to a plant, but the cumulative effect of numerous infections in every leaf interferes severely with normal growth, and causes early defoliation. When the fruit is attacked early in the season the bunch takes on a greyish-white appearance, and gradually dries up. This form is termed grey rot. If the fruit is further advanced when the attack occurs, it becomes more or less discoloured, finally assuming a dull red colour, softens and starts to rot, giving rise to the form known as brown rot. The leaves, however, are most subject to attack, and even in a mild case the crop suffers indirectly, as the reduced leaf surface for the elaboration of sap causes the fruit to yield a juice of lower quality and smaller quantity than is normal. These faults naturally show out in the finished wine or dried fruit, as the case may be.

Control Measures.

It has been shown that it is impossible to reach the winter spores of this fungus, as they lie scattered all over the ground wherever diseased leaves and fruit have decayed, and it is also impossible to reach the fungus, once the vines are infected. The treatment therefore can only be a preventive one, and it aims at destroying the zoospores before they gain an entrance to the herbaceous portions of the plant. These spores are particularly sensitive to the soluble salts of copper, very dilute solutions of which are sufficient to bring about their destruction.

Showing oil spots on upper side of leaf.
[After Ravaz.]

Any substance applied to the leaves as a spray, to be of any value, must be slightly soluble only, so that the first shower of rain

Vines sprayed with 10.5.50 Bordeaux mixture on 16th and 27th October; 17th and 28th November. Compare results with those of same test shown on following page.

does not wash it off, and yet sufficiently soluble for a rain drop to be able to dissolve a trace of copper. The compound must maintain its properties when exposed to the air, and it must also be sufficiently adhesive to remain on the leaves after drying.

Bordeaux Mixture.

The soluble salts of copper are among the most powerful fungicides known. Pure copper sulphate is too soluble, it not only washes off easily, but is absorbed by the leaves, and causes their destruction. The French preparation known as Bordeaux mixture, when correctly mixed and applied, is undoubtedly the best fungicide known for the control of this disease.* This mixture was accidentally discovered some 50 years ago, and although nothing has been found superior to the original constituents, viz., bluestone and quicklime, constant research has shown that the method of preparation has an important bearing on the quality of the spray. The first point to bear in mind is that the dissolved ingredients must not come in contact with one another except in a dilute form, otherwise a coarse precipitate will be formed which has neither good spreading nor sticking powers. The theoretical method is to dissolve each constituent in half the bulk of the water to be used, and then pour the two dilute solutions together into the spray cart; but in practice the usual method is to fill the spray cart to about three-fourths of its capacity with water, then stir in the dissolved bluestone, add the milk of lime slowly, stirring continuously while the addition is being made. Milk of lime or slaked lime is prepared by weighing into a kerosene tin the necessary amount of freshly-burnt lumpy quicklime, adding about a quart of water every half-minute or so until the lumps break down. Great heat is evolved, and a certain amount of splashing occurs during the slaking process, and care should be taken to avoid swamping the lime with too much water at the outset, as in this way only can a good milk of lime be prepared. After two or three minutes, the slaked lime can be diluted with plenty of water, stirred well, passed through a sieve, and finally added to the dilute bluestone solution. The contents of the spray tank are stirred vigorously while this addition is being made, and the tank is then topped up with water to the liquid quantity originally intended.

Deterioration of Chemicals.

Crystals of copper sulphate, or bluestone as it is more commonly called, do not degenerate to any great extent in storage. They have a tendency, after long storage, to break down

* Other fungicides such as lime sulphur are advocated for special orchard purposes, not because they possess superior fungicidal or lasting qualities, but because they may have an insecticidal value and do not cause the appearance of russet on apples and pears, &c. Repeated sprayings of lime sulphur have a stunting effect on growth, and therefore in the case of vines, lime sulphur is advocated as a suitable spray only at bud burst for the control of erinose.

into a powder, owing to the loss of water of crystallization. In this powdered form it is therefore a more concentrated substance than when in the crystalline form, but as most recipes for Bordeaux mixture recommend an excess of lime, this point is of little consequence.

Quicklime, on the other hand, is a substance which may deteriorate very rapidly if stored in bags for a month or so. It gradually changes from its lumpy nature to a powder, expanding in bulk and weight as it does so. In other words, it takes up carbon dioxide from the air, and changes from oxide of lime to carbonate of lime, and as such is useless as a constituent of Bordeaux mixture. For spraying purposes quicklime can be preserved from deterioration by making it up into the form of a stock solution of milk of lime or lime hydrate by adding a known quantity of quicklime to a known quantity of water—say, 50 lb. to 10 gallons. In this state it will keep almost indefinitely, as the water keeps the air out of contact with the lime. Very little of the lime hydrate goes into solution; the bulk of it settles to the bottom, and must be brought into suspension by stirring before drawing off any measured quantity for spraying purposes. Every gallon drawn out will contain an equivalent of 5 lb. of quicklime. This system saves slaking small quantities of lime each time a spray cart has to be refilled, as well as preventing the lime from reverting to the carbonate or limestone form. Trade preparations of oxide of lime and hydrate of lime in sealed tins are available, and should be preferred to quicklime of doubtful quality.

Stock solutions of bluestone also can be prepared in wooden containers by adding 1 lb. of bluestone per gallon of water. The bluestone dissolves best if suspended in a bag just beneath the surface of the water. If wanted quickly, it is dissolved with the aid of hot water.

Acid, Neutral, or Alkaline Bordeaux.

According to the proportion of slaked lime added to the bluestone, so the properties of the mixture will vary. Although in the past, acid, neutral, and alkaline Bordeaux mixtures have been advocated, the present-day opinion is strongly in favour of an alkaline solution owing to its better lasting qualities. The acid and neutral forms dissolve and disappear too rapidly. When dealing with pure chemicals, the most effective alkaline mixture is obtained by using 4 lb. lime to 10 lb. bluestone. The usual formula stipulates half as much lime as bluestone, thus making liberal allowance for the impurities usually found in commercial quicklime.

The mixture known as the 1 per cent. solution contains 10 lb. of bluestone and 5 lb. of quicklime per 100 gallons of water. Early in the season and during a wet season the application of a 2 per cent. solution, viz., 10 lb. bluestone, 5 lb. quicklime, and 50 gallons of water

Left, showing vine dusted with a copper containing powder on 27th Oct. and 22nd Dec.; Right, untreated control vine.

Dusting powders are supplementary to, not substitutes for, Bordeaux sprays. Black spot tests—Left, untreated vine; centre, sprayed four times; right, dusted seven times.
[Photos by Govt. Printer, N. S. Wales.]

is advisable. Before there is much foliage, 40 to 50 gallons of spray per acre are sufficent, but for later sprayings at least 100 gallons per acre are required. The spreading power of the spray is improved by dissolving 5 oz. casein in a pint of water containing 2 oz. washing soda or ½ oz. caustic soda.

The mixture should definitely be alkaline, and this can be proved by the fact that red litmus turns blue on immersion, phenolphthalein paper turns pink, or if a bright wire nail be immersed for several minutes no red metallic copper should be deposited on its surface.

If the mixed spray is allowed to stand, the bluish copper precipitate should settle, and the liquid above should be colourless. Also, if the mixture is not alkaline, the casein spreader will curdle. Finally, seeing that the copper precipitate is in suspension, and not in solution, the mixture should not be allowed to stand long before use, and continual agitation is necessary while the spray is being applied.

Time to Spray.

The spraying, being essentially a preventive treatment, must precede the infection of the plant, for once the fungus has penetrated the plant tissue, all fungicides are powerless so far as that particular invasion is concerned. Later sprayings are, of course, useful in that they prevent further infection, which may occur during the summer if conditions are favorable.

Warm, very wet weather, as occurs frequently in mid-spring, favours the germination of the winter spores, and experience has shown that the first spraying should be applied shortly before the middle of October, when the young shoots have reached a length of 6 to 10 inches. The second spraying should be applied shortly after flowering, or three or four weeks after the first application. This will protect the young fruit bunches and the growth produced since the first spraying. In wet seasons it may be thought advisable to spray a third time, about a month after the second. This is a far superior practice to that of "topping" the growth made since the previous spraying, because in seasons favorable to downy mildew one of the greatest difficulties is to get the grapes to ripen well, owing to the shortage of foliage, as leaves infested with the disease are shed very early.

Finally, if the weather conditions during any part of the growing period appear to be particularly suitable for the spread of the fungus, additional sprayings must be applied to ensure protection, especially if it is intended to renew former coats of spray, which have been subjected to very heavy rains, or to cover new growth which has appeared since the previous spraying.

Substitutes for Bordeaux Mixture.

In the hands of a novice some of the commercial preparations, which before use simply need the addition of water, may give reasonable results. When a few gallons only of spray are required, these preparations may save much time and trouble, but when working on a commercial scale there is nothing that will prove

(Continued on page 524.)

Phylloxera-Resistant Vine Stocks (II.)

Including Some Recent Introductions

By F. de Castella, Viticulturist.

Hybrids of V. Berlandieri and V. Rupestris.

THESE hybrids constitute an interesting group, the striking merits of which met with tardy recognition, for it is only within the past twenty years that they have come into extensive use in Europe and Northern Africa. Though not yet grown commercially in Australia, they nevertheless present features that should make them particularly interesting under our warm conditions. In Algeria, several of them have recently become very popular.

Rupestris, having superseded Riparia, especially in warmer climes, it would seem logical to look for better results from the crossing of *V. Berlandieri* with the first, than with the second of these species. This anticipation has been realized, and in this sub-section are several vines of great value.

It is true that the stocks of this breeding, that were first made available, were inferior in vigour to those developed since. Disappointment led to their being discarded and to valuable aptitudes in other directions being entirely overlooked.

As in the case of the *Berlandieri Riparia* hybrids, crossing with *V. Rupestris* has largely corrected the difficult striking of cuttings and slow early growth of *V. Berlandieri,* whilst retaining in large measure its good qualities. The Rupestris "blood" has, in addition, brought to these hybrids much of the "rusticity" of that species, enabling them to thrive on poor land. They should thus be even better suited for poor soils than are 420A and the other *Berlandieri Riparias.* But they also inherit from *V. Rupestris* its bushy habit of growth, and it was this, coupled with the restricted above-ground development, derived from the *Berlandieri* parent, that relegated the early members of the group to an obscurity they scarcely merit.

Their much-branched, twiggy growth results in a poor yield of cuttings, suitable for propagation. Hence they are not what the French term "nurserymen's vines", and the popularity of a stock largely depends on the favour of this branch of the industry.

The root system is strong, fleshy, rather plunging, and much branched. Though the phylloxera-resistance is ample for all purposes, insects are more plentiful on their roots than on those of pure *Berlandieris,* a curious fact in view of the very high resistance of the Rupestris parent. These vines are highly lime-tolerant, though not to quite the same extent as the *Berlandieri Riparias.* This is as might be expected, seeing that *V. Rupestris* is rather more liable to lime chlorosis than is *V. Riparia.*

Several groups of this breeding are in use; the oldest, raised by Millardet and de Grasset, in the eighties, failed to command public favour and are little used to-day. Another and more vigorous group raised by Richter, the well known Montpellier nurseryman, has, however, come to the fore rather recently, especially in Algeria. Similar hybrids have also been raised in Italy by Paulsen, Ruggieri, and Grimaldi; they are highly spoken of in that country, but have not yet found their way to Australia.

Millardet's Rupestris x Berlandieri Hybrids.

The best known are No. 219A raised in 1884 and Nos. 301A and 301-64 raised in 1887. These vines did not come up to expectations, and have been little used in Europe. Viala and Péchoutre* consider them inferior to the best *Berlandieri Riparias* and especially to No. 420A. They also found them less lime-tolerant and not more drought-resistant, and that their cuttings strike less freely and are less easy to graft. They anticipate that they will prove less "ameliorating" in the direction of wine quality. A verdict that seems unduly severe, for they are good stocks, though presenting the limitations pointed out above, from a nursery stand-point. The appearance of the

* *Ampelographie* Vol 1, p. 455.

No. 219A.—One of the best known Rupestris x Berlandieri hybrids. (Half natural size.)

mother vine scarcely inspires confidence, its twiggy, much-branched growth being anything but attractive. The spindly cuttings are unsuitable for bench grafting, but when struck in the nursery, planted out as ungrafted rootlings and field-grafted, the Vinifera scions grow more strongly than do the tops of the ungrafted vines, developing quite normal strength, the stock thickening in sympathy, to provide a stout, durable stem. The vines are fruitful and drought-resistant, if not of very vigorous growth. This last, however, is a characteristic that often misleads. It is not necessarily the strongest growers that are most remarkable for yield or quality of fruit. As regards drought-resistance; a stock that makes for moderate scion development is obviously less exacting as regards soil moisture than one that promotes excessive "top-hamper".

These three stocks, each grafted with nine different Vinifera scions, have been under observation since 1923 in the affinity plots at the Rutherglen Viticultural Station, where they show greater merit than their lack of popularity in France would lead one to expect. They seem, indeed, to be better suited for our warmer conditions, and are at least equal to the *Riparia Rupestris* Nos. 3306 and 3309. They are especially interesting as regards affinity for "difficult" scion sorts, such as Muscat Gordo Blanco, Ohanez, and Zante Currant. Of the three, Nos. 301A and 301-64 are definitely superior to No. 219A in vigour of growth and also in yield of fruit. There is little to choose between the two former, though 301A is perhaps the best of the three. Gordo and Zante on this stock are particularly good, though Gianetti is perhaps better on 301-64.

Millardet raised several other *Rupestris x Berlandieri* hybrids such as 301C, 301-37, and 17-37*. In the raiser's opinion 301A is the best of this group. It is the one that is most resistant to phylloxera. They all strike fairly well from cuttings, and present the characteristics of all the Berlandieri hybrids of being very easy to graft and having good affinity for most Vinifera scions.

According to M. Nayrac†, 301-64 is one of the best stocks at Marville experimental vineyard, near Cognac, more in the direction of fructification than of vigour, though the latter is not at fault. It is a little less resistant to chlorosis than 41B.

Though these stocks deserve mention, and seem to be worthy of further observation, they are overshadowed by the more vigorous group about to be described.

No. 301A.—A Rupestris x Berlandieri hybrid. (Half natural size.)

* No. 17-34 is a spontaneous hybrid elected by Millardet, that was unduly overlooked. It has received more attention recently in France. It was popular at one time in Sicily in spite of difficult cutting propagation, but was displaced by locally raised hybrid stocks.

† *Progrès Agricole*, 16 March, 1930.

Richter's Hybrids.

These remarkable stocks were raised by the late F. Richter, the well known nurseryman of Montpellier (France), when the quest was keen for new stocks to overcome adaptation difficulties encountered in certain localities, the object being to retain by hybridisation valuable aptitudes possessed by a few stocks that were defective in other directions. *Vitis Berlandieri* was naturally indicated as one of the parents, for this species shows greater lime-tolerance and drought-resistance than does any other wild American species.

Though raised in 1889, it was not until twenty years later than they became known to viticultural practice, conscientious scruples restraining their raiser from taking the risk of putting these new stocks on the market, until their value had been fully established.

The first full description of these vines seems to have been an article that appeared in *Progrès Agricole* in November, 1912, from the pen of the late Jules Leenhardt Pomier, one of the most enlightened and progressive of the large vine-growers in the Montpellier district. These stocks soon became popular, and to-day they are largely used in Southern France and even more so in Algeria. Their success in this climate, which is warmer than that of France, makes them particularly interesting under Australian conditions. In Algeria they tend to supersede the *Berlandieri Riparia* hybrids, which sometimes weaken from over-production resulting from too generous pruning (see June issue, p. 288). They are much superior to Millardet's earlier hyrids (301A, &c.) as regards vigour, yielding stouter and longer canes much better suited for propagation and capable of being bench grafted. They retain the favorable influence of *V. Berlandieri* on yield and quality, though whether ameliorative of the latter to quite the same extent as the *Berlandieri Riparias* is not yet clear. Cuttings strike reasonably well, and their easy grafting makes them very suitable for field grafting. They certainly rank among the most promising of the newer stocks.

It will be noted that these vines are *Berlandiera* x *Rupestris* hybrids, the first named being the seed bearer and not the pollen parent as was the case for those of Millardet, who also used earlier Rupestris types not equal in vigour to those available a little later.

Richter selected as fruiting parent the vigorous forms known as *Berlandieri Resseguier* Nos. 1 and 2, and also a variation of the second of these known as *Berlandieri de las Sorres*. For pollen parents he used *Rupestris du Lot, R. Martin* and a now obsolete stock known as *Novo Mexicana*.

No. 99R: *Berlandieri de Las Sorres* x *Rupestris du Lot*.—This hybrid produces very vigorous though rather slender growth early in the season, thickening later to produce fairly stout cuttings. Sprouts and young canes are brilliant coppery red, tips bent in the form of a crook. The flowers being staminate, this vine does not produce fruit. The leaves, of rather dull texture,

No. 99R.—A very promising of Berlandieri-Rupestris stock. (Half natural size.)

are intermediate between the two parents, the very open almost "bracket-shaped" petiolar sinus recalling *du Lot*. The strong root system likewise somewhat resembles this parent, and demands a penetrable sub-soil, where the plunging roots can establish themselves deeply. In shallow soils, where this is not possible, it may suffer, though to a lesser extent than *du Lot*.

Phylloxera-resistance is ample in any soil, and lime tolerance is considerable, though not equal to that of No. 31R. Affinity is good with all the scion sorts grown in Southern France, which benefit from the well known ameliorative influence of the *Berlandieri* parent on yield and quality.

The strike of cuttings is somewhat irregular, rendering this stock of doubtful value for bench grafting. It is, however, excellent for field grafting, the union being rapid and perfect, as is usual with *Berlandieri hybrids.* Cuttings from mother vines grown under dry conditions, where the wood ripens early, strike more easily.

No. 110R: *Berlandieri Resseguier No. 2* x *Rupestris Martin.*—This is a vigorous vine, producing cuttings of good diameter that strike fairly easily, though scarcely enough for bench grafting. Sprouts and tips of young shoots are of intense coppery red; full grown leaves thicker more glossy and with peliolar sinus less open, than with the foregoing; flowers mostly staminate; the others fail to set and no fruit is produced. The root system is exceptionally powerful. Though the roots are not very numerous, they are strongly developed, not much branched, and of ample resistance to phylloxera. They have considerable powers of penetration, fitting this stock for stiff clayey soil, unsuitable for the *Riparia Rupestris*

No. 110R.—A Berlandieri x Rupestris hybrid. (Half natural size.)

hybrids. Lime tolerance is fairly high—up to 45 per cent. and over of calcium carbonate. It is also claimed to be suitable for dry situations. Its pollen parent, though no longer used to-day, was one of the most drought-resistant forms of *V. Rupestris.* It is easily grafted and confers good fructification and quality to scions grafted on it.

No. 31R.—Another Berlandieri x Rupestris hybrid. (Half natural size.)

No. 31R: *Berlandieri Resseguier No. 2* x *Novo-Mexicana.*—The pollen parent in this case was a very vigorous wild American, closely related to the once popular *Solonis**; these vines were held by Munson to belong to a species he named *Vitis Longii,* the specific nature of which is denied by French authorities, who consider these and several other allied vines to be spontaneous ternary hybrids, in the breeding of which are concerned *V. Riparia, V. Candicans,* and *V. Rupestris.*

No. 31 R. differs from the two previous vines, chiefly in its sprouts and young tips, which instead of being deep coppery red are of a dull green colour with only a few splashes of rosy violet. The tips are also less bent. The young leaves at first recall *V. Riparia,* but they soon undergo an abrupt change, assuming a Rupestris appearance. The petiolar sinus is also deeper.

It is, among Richter's hybrids, the one that strikes best from cuttings; sufficiently, in fact, to give a good percentage of success when bench grafted and callused in artificial heat. It is also the most lime-tolerant, thriving in soils containing 65 per cent. and over of

* Though 31R is really a complex hybrid it can consistently be dealt with here, together with Richter's other creations.

calcium carbonate. In addition to these qualifications it presents the advantages shared by the other stocks of this group in the direction of vigour, rapid growth, rusticity, phylloxera-resistance, easy grafting and promotion of yield and quality. It is claimed by the raiser to be very drought-resistant.

No. 57R: *Berlandieri Resseguier No. 1* x *Rupestris Martin.*—If this vine is less known than the foregoing ones, it is not owing to any inferiority shown by it, but merely to the fact that it has been propagated less, and hence it is more difficult to procure. Its popularity is on the increase in France.

It is of similar breeding to No. 110, except that a different form of *Berlandieri* was used as seed bearer. It has coppery red sprouts and cane tips, similar to those of 110, but the leaves differ somewhat, being less entire; they are, in fact, often 3 and even 5-lobed. It has complete flowers, but they mostly fail to set, only a very few small black grapes, with little pulp, reaching maturity.

In vigour and other desirable qualifications, it much resembles No. 110 and, like it, seems to be well suited for hard, stiff soils, though its root system is scarcely as powerful. Its cuttings, however, strike more easily, though not as well as those of No. 31. It is, nevertheless, said to give fair results when bench-grafted. In lime-tolerance it is not the equal of No. 31, being about on a par with No. 110. Its drought-resistance, which is said to be very satisfactory, is no doubt partly inherited from its *Rupestris* Martin parent. J. Alpheran* testifies to its good drought-resistance on soils with a hard impenetrable clay sub-soil, where *R. du Lot* is unsatisfactory and distinctly inferior to these *Berlandieri* hybrids, among which he gives first place to R.57 and second to R.31, as regards foliage and fruit, after the very dry summer of 1931.

No. 44R.—This is another of Richter's *Berlandieri* x *Rupestris* hybrids, but particulars are lacking concerning its exact breeding and aptitudes. It has come into prominence of late, at the Montpellier School, where it compares favorably with 99R, 110R, &c., according to recent reports.

* * * *

Evidence as regards vigour and productivity of the Richter hybrids, is contained in an article by Ravaz and Verge† reviewing the behaviour of some 80 different stocks in the experimental plots of Montpellier School of Agriculture.‡ Some of these are grafted with Aramon, some with Panse (Valensi), and some with Cinsaut (Blue Imperial).

The following extracts from this article show the results obtained from the Richter hybrids, grafted with Aramon, in comparison with some other well-known stocks grafted with the same scion. The figures, expressed in kilogrammes per vine, represent the average annual weights, of prunings and of fruit, over a six-year period from 1916 to 1921:—

Stock.	Weight of Prunings.	Weight of Grapes.
	Kilogrammes.	Kilogrammes.
Riparia Gloyre	0·355	1·794
Rupestris du Lot	1·075	3·301
V. Berlandieri Richter ..	0·522	4·112
No. 3306 (Rip. x Rup.) ..	0·967	4·572
No. 3309 (Rip. x Rup.) ..	0·682	4·481
No. 34E (Berl. x Rip.) ..	0·573	3·301
No. 420A (Berl. x Rip.) ..	0·663	3·603
No. 44R (Berl. x Rup.) ..	0·892	5·037
No. 99R (Berl. x Rup.) ..	0·839	5·312
No. 110R (Berl. x Rup.) ..	0·979	5·083
No. 31R (Berl. x Rup.) ..	0·752	4·367
No. 57R (Berl. x Rup.) ..	0·869	4·698
No. 1202 (Vin. x Rup.) ..	0·654	3·139
No. 93·5 (Vin. x Rup.) ..	0·693	2·354
No. 41B (Vin. x Berl.) ..	0·615	4·364
No. 333 (Vin. x Berl.) ..	0·555	2·503
No. 18804 (Rip. x Montic.) ..	0·766	4·114
161–49 (Rip. x Berl.) ..	0·515	2·414
17–37 (spontaneous Berl. x Rup.)	0·618	3·430

It will be noted that of all these stocks, Richter's group of hybrids gave the highest yields of fruit, with 99R as heaviest bearer and 110 in second place, whilst vegetative vigour, as measured by the weight of prunings, compared favorably with other well-known stocks, 110R, which was the strongest grower, being second only to *Rup. du Lot.*

In observations on similar lines, published in 1928 by Ravaz and Branas, giving averages from 1922 to 1926 of the same vines,§ these Richter hybrids are still to the fore, with 110R first and 57R second, for fruit yield. Their vigour has increased somewhat, the strongest growers of the group being 44R and 110R, which are but little behind du Lot in this respect.

At the 1927 vintage, 44R yielded most grapes, 99R being second, whilst 57R, 31R, and 110R were equal for third place.

* *Progrès Agricole*, 6th September, 1931. † *Progrès Agricole*, 30th April, 1922, et seq. ‡ The soils at Montpellier school are of rather patchy nature and contain from 18 to 38 per cent. of calcium carbonate. § *Progrès Agricole*, 15th January, 1928, et seq.

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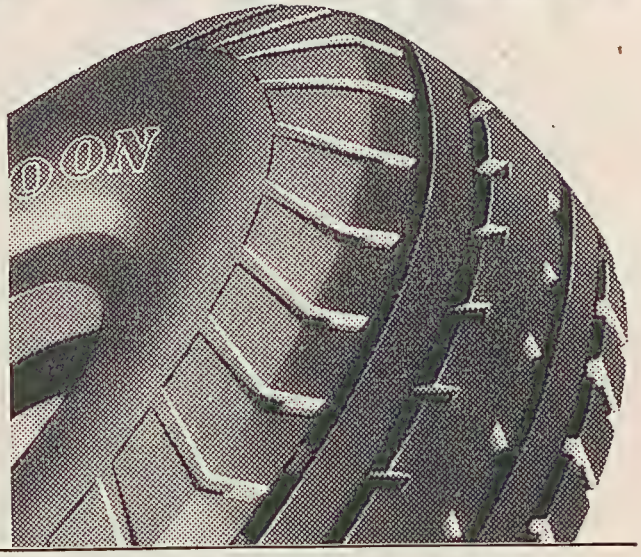

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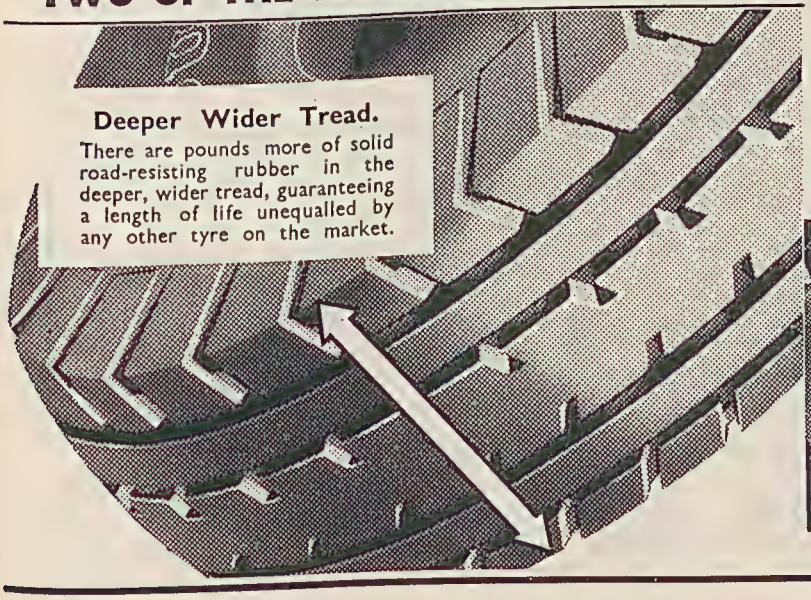

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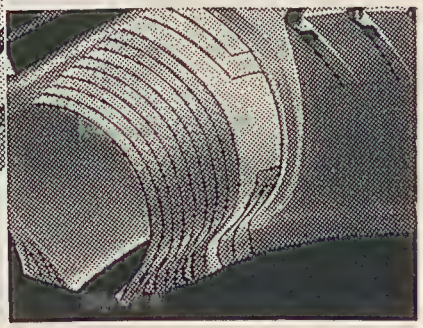

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It does not necessarily follow that in all soils these stocks should show such marked superiority, but the above figures, compiled by such an authority as Professor Ravaz, certainly constitute strong evidence in their favour.

J. Leenhardt-Pomier (*loc. cit.*) commented on their late sprouting in spring, a valuable characteristic they communicate to the scion, that often provides escape from early spring frost injury.

More recently still (7.1.1934) in an article on the *Rupestris-Berlandieri* stocks, Professor Ravaz says—

> The Richter hybrids are very widely disseminated to-day; they are also the best known. Their numbers are 57, 99, 110 and some others perhaps of less value. In Southern France and Spain, they are becoming more and more important, and in Algeria they are being substituted for the *Riparia-Berlandieri*—which are weakening through over-production, that is to say, through too generous pruning—and sometimes even for *Rupestris du Lot*, which, however, is not devoid of merit. They strike well from cuttings and are easily grafted in the field or at the bench.
>
> The values of these numbers are much on a par, judging by yield or the F/V ratio (F. representing yield and V. vegetative vigour). The differences noted, vary from year to year, sometimes in one direction, sometimes in another. I have seen 57 the equal of 99 and 110. It seems that to-day, in Algeria, 99 is beating 110, at least for stiff soils. In France they seem to me to be practically equal.

Professor Ravaz sums up, in the same article, the general characteristics of all the *Berlandieri-Rupestris* hybrids as follows:—

> They are vines of great vigour: trunk thickening rapidly, giving fine vines that stand well, from the earliest years. Fructification very good in hot countries; less good, naturally, in cold or rainy regions, where maturity may also be retarded.
>
> They are thus good stocks for calcareous soils, in Southern France, Spain, Italy, and North Africa. These qualities are evidently linked up with the nature of the root system. They strike sufficiently well from cuttings, but less well, however, than Rupestris, and as the roots are less numerous they are also stronger and more fleshy (Berlandieri characteristics) and longer, and are able to penetrate more deeply in stiff soils that present fissures, or are more or less stony, to find the coolness that the surface roots lack.
>
> Their phylloxera-resistance is of the very first order, although roots that form near the collar show fairly numerous shallow tuberosities.

These rather lengthy quotations are, in the writer's opinion, justified by the great interest these vines present in our warm climate, which should suit them even better than that of France. It must be remembered that both parents are natives of hot regions. Their growing popularity in Algeria confirms this view. Though essentially lime-tolerant and recommended chiefly for calcareous soils in France, they do not need lime and thrive, equally with other stocks, in soils of low lime content. Their other qualifications, and especially their remarkable influence both on yield and quality, are of sufficient importance to assure them a high measure of success in Northern Victoria.

No. 261-50.—Though not one of Richter's hybrids this Berlandieri-Rupestris, raised by Conderc, deserves brief mention. It has recently attracted attention in France as a stock of value. Being a "late comer" and but little advertised, it is not widely used as yet.

Hybrids of V. Vinifera and V. Berlandieri.

The European vine, *V. Vinifera,* has been crossed with *V. Berlandieri,* just as it has with *V. Rupestris* and others, and among the *Vinifera-Berlandieris* we have a few highly interesting hybrids. The main object of this cross was to overcome the difficulty of striking the *Berlandieri* cuttings, whilst yet retaining its lime-tolerance. The result has been to even enhance the latter characteristic, for some of these hybrids can stand even more lime than the pure *Berlandieri.* It must be remembered that *V. Vinifera* is the most lime-tolerant of vines; on its own roots it remains green in some of the soils near Cognac, that produce the choicest brandy, and contain up to 80 per cent. of calcium carbonate in chalky form. Here, even pure *Berlandieri* may show symptoms of chlorosis, whilst most other Americans soon succumb to it. The creation of these hybrids has thus rendered possible the reconstitution of the most difficult soils in this privileged region. According to Ravaz*—

> The *Vinifera-Berlandieri* are of medium vigour, less than that of *V. Vinifera;* canes and main stem rather strong, root system fairly powerful, fleshy, developing easily enough on cuttings; phylloxera-resistance very variable—sometimes very good; adaptation easy: all soils suit these vines, but they only dominate varieties belonging to other groups, in chalky soils, very liable to cause chlorosis. In these they are incomparable. Whether grafted or not, they develop as well as Vinifera sorts, on their own roots. If they sometimes show "yellowing" in spring, they soon become green again. They never suffer appreciably from chlorosis. For chalky soils they constitute stocks of the first order. The graft knits very well, and if they do not communicate great vigour to the scion, they give it very great fruitfulness; they suppress, or appreciably attenuate coulure; the bunches are well constituted, ripening proceeds normally and regularly in all soils, dry or otherwise, so that the quality of the wine is nearly always assured.

* *Les Vignes Americaines,* by L. Ravaz, Coulet and Co., publishers, Montpellier, p. 290.

Doubts were raised concerning the phylloxera-resistance of these vines by Viala and others. It certainly is not quite equal to that of several "Americo-American" hybrids, yet it is quite ample in the vast majority of cases and superior to that of such well-known stocks as A R G I and 1202. It is indeed curious that *V. Berlandieri,* which is rather less resistant than *V. Rupestris,* should, when crossed with *V. Vinifera,* produce hybrids more resistant than the majority of *Vinifera* x *Rupestris.*

Branas and Aldebert, reviewing the behaviour of several stocks at Montpellier

No. 41B.—A well known French stock.
(Three-eighths natural size.)

School,* say of the Vinifera Berlandieris—"The phylloxera condition of 333EM and 41B is as good as that of *Rupestris du Lot* and *Riparia Gloire.*" They also credit another hybrid of the series, No. 422-39-21M & G, reputed to be a good stock for table grapes, with equally satisfactory resistance. They mention another vine of the series, however, (*Vinifera-Berlandieri Crozes*) that weakened from the attack of the insect.

The resistance of the best of these vines is seldom questioned in Cognac, where the soils are very "phylloxerating," for it is a well-known fact that lime aggravates the virulence of phylloxera. They should, therefore, prove amply resistant in Australian soils, where the insect is much less deadly.

The best known are 41B and 333, though several others, such as 19-52, 422, 374, 184, and some Italian hybrids raised by Grimaldi, with *Vinifera* as pollinator, are also well spoken of. Of these the first two have been tried in Victoria, and also in New South Wales. Though good stocks, their vigour, after grafting, is in many cases scarcely sufficient. They do not make big vines. The members of the group scarcely promise, in our low lime soils, to fulfil the sensational claims made for them elsewhere—with us, other stocks usually show more promise. Nevertheless, these vines present those very desirable characteristics, peculiar to *Berlandieri,* and it is quite possible that any one of them may show special aptitude for some particular scion sort, as, for example, 41B for Gordo Blanco in California. Their further trial is, therefore, well worth while, even on ordinary low lime soils. For soils of very high lime content they can be recommended with confidence as stocks of the highest value.

No. 41B: *Chasselas* x *Berlandieri.*—Raised near Bordeaux in 1882 by Millardet and de Grasset. Flowers of Green Chasselas (*Vinifera*) were fertilized with *Berlandieri* pollen from Gard Department. Of fourteen seedlings, planted on land just cleared of vines dying from phylloxera, two grew well and were labelled A and B, the former proved a "stranger" with Rupestris features, but B showed marked *Berlandieri* affiliation; it was designated No. 41B. It was multiplied, tested, put on the French market, and it soon became enormously popular, for it has, more than any other stock, rendered possible the reconstitution of the most difficult chalky soils of Cognac.

The plant combines features of both parents. The smooth texture of the leaf (above), the "wave" and the tendency to curl under, recall Chasselas (see photo), whilst the shape is almost *Berlandieri.* The canes are few in number, thick and slightly ribbed; cuttings strike reasonably well, though scarcely well enough for bench grafting. The root system, more *Berlandieri* than *Vinifera,* is very powerful. The roots, though not numerous, are of considerable length, not much branched, and of plunging nature. They dislike damp conditions, which may even prove fatal; good

* *Progrès Agricole,* 6th October, 1929.

drainage is, therefore, essential. Good drought-resistance is claimed for this stock in France, where it is recommended, on this account, as well as for its other *Berlandieri* characteristics, even for low-lime soils.

In California 41B is in good repute. Bioletti, Flossfeder, and Way* assign it first place as a stock for Muscat of Alexandria (same as our Gordo Blanco). It is also given first place as a stock for Sultanina (our Sultana), Black Corinth (our Zante), Flame Tokay, and Alicante Bouschet.

In New South Wales, according to H. L. Manuel†, it is satisfactory with several scion sorts, but not outstanding except for Ohanez, and in lesser degree for Sultana and Gordo Blanco, Shiraz yielded well on it, but growth was not strong, as was also the case for several other scions.

At the Rutherglen Viticultural Station, in a very dry situation, it is true, its fruiting is not superior to standard stocks such as 3309, A.R.G.I., &c.; whilst its growth is rather less. Affinity is good with all scions tried on it. Carignane, Alicante, Bouschet, Grenache Montils, and Sultana are satisfactory on it, as is also Gordo Blanco, though the growth of the last is not strong. Zante, Mondeuse, Purple Cornichon, Mataro, and Malbeck are rather weak.

Typical leaf of No. 333. (Five-twelfths natural size.)

Leaf of No. 333 showing Cobarnet parentage. (Five-twelfths natural size.)

41B has been planted in some commercial vineyards in our North-East. Though satisfactory, it is not equal to 420A and older stocks, such as 3309, &c.; vines grafted on it develop slowly at first. On the whole, and especially in view of its French reputation, it has proved somewhat disappointing here. The explanation is perhaps provided by remarks of M. Nayrac (*loc. cit.*), concerning its reputation in the Cognac district, where it is said to be "greedy," not as regards soil though, for it adopts itself to shallow, chalky, land, where few stocks can grow, but from the stand-point of manuring—on soils where Rupestris develops normally with little manure, 41B may weaken. If adequately "fed," however, the latter would give better results than Rupestris.

No. 333: *Tisserand-Cabernet-Sauvignon* x *Berlandieri.*—Raised by G. Foex, at the Montpellier School, of which he was principal. In appearence it is intermediate between the two parents, with a leaning towards the seed-bearer (Cabernet). The typical leaf is almost entire, but on every vine, many leaves can be found that distinctly recall the deeply cleft Cabernet leaf. Its flowers are staminate. It is a strong and rapid grower, more so than 41B, and its cuttings strike more easily; sufficiently so for bench grafting. It grafts very easily, though according to Nayrac the unions are sometimes

* Bulletin 331, University of California Publications, October, 1921, p. 129.
† Resistant Stocks in New South Wales. Paper read at the Eleventh Interstate Wine Congress, Adelaide, 1930.

rather tender at first. It communicates vigour and fruitfulness to the scion, and is ameliorative of quality, in high degree. Its root system is powerful, and takes a good deal after the pollen parent. It stands "wet feet" much better than does 41B, and being equally, if not more lime-tolerant, it is admirably suited for moist, limy soils, where chlorosis is particularly to be feared. It is nevertheless, also reputed to possess good drought-resistance. No. 333 did not for a long time meet with the popularity its real value merits. Its raiser, though a leading vine authority of his day, was not a commercial man; hence it was not "boomed" by nurserymen as other stocks

No. 19-52.—Vinifera x Berlandieri (a spontaneous seedling). (Three-eighths natural size.)

were. It also received a setback in 1892, when its phylloxera-resistance was questioned by Viala, as the result of certain observations. Its undoubted qualities in other directions have caused it to progress steadily, and to-day it is generally in high esteem. Though its resistance is perhaps not quite equal to that of 41B, it is, in the great majority of cases, amply sufficient, as witness the recent opinion of Branas and Aldebert quoted above. It would nevertheless, be wise not to plant it in very dry, "phylloxerating" situations. On the whole, 333 must be regarded as an excellent stock. Even Viala, apart from his pessimism concerning its resistance, states that, but for this, it would incontestibly be much superior to 41B, by its greater vigour, and easy propagation from cuttings and grafting.

In California, Bioletti, Flossfeder and Way (*loc. cit.*) say of it—

"This hybrid lacks completely the defects of the *Berlandieri;* that is, it roots easily and develops quickly. There seems to be some doubt as to its degree of resistance to phylloxera, but it can be safely planted in good deep soil, and it withstands drought well."

At the Rutherglen Viticultural Station, 333 figures well in the affinity plots—much better than 41B; it must be admitted, however, that it is on slightly better land. It is grafted with 20 different scion sorts, all of which are doing very well and bearing good crops with the exception of Clairette (Coulure), and Valensy and Gianetti, which are rather weak. The last-named is a difficult scion. Other difficult scions, such as Muscat, Gordo Blanco, Zante, and Ohanez, are doing very well on it. Part of the ampelographical collection is planted with this stock, and grafted with over 50 different scion sorts. All are satisfactory as regards affinity and yield, and growth is sufficient, though not over-vigorous. Vines on this stock should not be planted too wide apart. No. 333 is thus a very good stock—probably one of the best for very limy soils. In soils of low lime content it also presents interest by its marked Berlandieri attributes. It should be valuable under irrigation, in view of its toleration of damp soil conditions.

No. 19-52: *Vinifera* x *Berlandieri* (Spontaneous Seedling).—Though not much grown in France, this deserves mention, as it is doing well in the affinity plot at the Rutherglen Viticultural Station, where it has been under observation since 1923. It is to be regretted that its authenticity is in some doubt, owing to an obvious mistake in labels, since rectified. It was first planted as No. 160–19, a vine of entirely different breeding (*Rupestris* x *Monticola*), but it shows marked Berlandieri affiliation, as will be seen in the photograph, a composite one, that compares upper and under surface.* No. 19–52 being the only *Vin.* x *Berl.* imported in 1908, and not otherwise accounted for, this must really be the vine in question.

It is proving itself a very good stock, quite equal to 333 and superior to 41B under Rutherglen conditions. It was mainly grafted with

* See also photo V. Berlandieri, June *Journal*, p. 286.

Muscats owing to the mistake referred to; 160–19 is considered in Spain to be a good stock for Muscat Gordo Blanco.

The Berlandieri hybrids, with their excellent all-round affinity, are also good stocks for these rather difficult scions, and these vines are, ith one exception, doing very well on 19–52. Muscat Gordo Blanco, Red Hanepoot, Cannon Hall Muscat, Snow's Muscat Hamburg and Moscato Paradiso are very satisfactory, but Princess Alexandra, a rose-coloured Muscat that seems particularly difficult to suit with a stock, is making rather poor growth, though bearing a good crop; perhaps over-production, rather than faulty affinity, is to blame.

No. 422B.—*Pinot Blanc* x *Berlandieri*, raised by Millardet. This member of the same group deserves mention. Though neglected for a good many years, it has of late received more attention, especially as a stock for table grapes.

Tobacco Investigations

(Continued from page 481).

TABLE XI.—VARIETY TRIALS.—STOCKDALE, 1934–35.

Grades of leaf expressed as percentage of whole.

Treatment (Per Acre).	1st Bright.	2nd Bright.	3rd Bright.	Mahogany.	Immature.	Scrap, Green, Dark.	Yield of Cured Leaf Per Acre 1934–35.
	%	%	%	%	%	%	lb.
Dungowan	20·2	31·4	12·3	5·6	14·7	15·7	278
Dungowan Selection	17·2	26·8	20·4	8·6	10·7	13·0	287
Conqueror				(No yield)			
Hickory Pryor				(No yield)			
Warne				(No yield)			

strain of Dungowan, although systemically infected, did not spot badly in the field, and produced an appreciable body of sound leaf, The judgment of many Victorian growers in their preference for this particular variety was strikingly vindicated.

The variety labelled Dungowan Selection originally was developed from a volunteer plant discovered growing in a Gippsland forest. At Stockdale, it apparently was slightly more mould resistant than Dungowan, and appeared to mature a little earlier. When grown in the north-east, these differences are not so marked, but the strain is being perpetuated until it has been established either as Dungowan, or something slightly different. During last season the general appearance, texture, and feel of the leaf produced were very attractive.

It would seem at the moment that the possible future of North or East Gippsland as a tobacco growing area will be determined by the degree to which this variety continues to exhibit a resistance to the disease blue mould, more correctly called Downy Mildew (*Peronospora tabacina*).

United Kingdom Fruit Imports

EARLY in August the Imperial Economic Committee issued a report on the production of and trade in fruit throughout the world. It has now published, as a supplement to its Weekly Fruit Intelligence Notes, its annual survey, "Fruit Supplies in 1934," in which attention is more particularly focussed on the amount of fruit available for consumption in the United Kingdom.

The most remarkable fact disclosed by this survey is that, although imports of raw fruit in 1934 were over 100,000 tons below the record quantity imported in the previous year, the inhabitants of the United Kingdom ate more fruit than ever before. This was due to a bounteous home crop, especially of apples, which brought the total available supplies up to a figure rendering possible a *per capit* consumption of nearly 96 lb. There has, in fact, been a constant growth in the consumption of fresh fruit for a number of years past. Thus in the five years 1924-28, total available supplies averaged 1,500,000 tons annually. During the next five years the average was nearly 1,750,000 tons, and 1934 broke all records with nearly 2,000,000 tons. The apparent *per caput* consumption was about 70 lb. in 1924, 88 lb. in 1933, and nearly 96 lb in 1934.

The 1934 record was due mainly to the exceptionally heavy supplies of apples. Supplies of oranges, on the other hand, were well below the 1933 figure, and consumption fell from 27 to 24 lb. per head. The apparent consumption of plums, grapes, and grapefruit reached a new high level in each case.

Although the production of fruit in the United Kingdom is increasing, on an average about three-quarters of the supplies available for consumption are imported from overseas. In the past 25 years the trend of raw fruit imports has been consistently upward, and imports are now nearly twice as great as before the war, the average for the five years 1929-33 being well over 1,250,000 tons as compared with less than 750,000 tons in the period 1909-13. The bulk of the total is still supplied by foreign countries, imports from which are some 50 per cent. greater than in pre-war years, but a relatively much greater advance has been made by Empire countries, whose contributions in the five years 1929-33 averaged more than four times the pre-war quantity.

Imports of raw fruit from Empire countries reached a new high level in 1934, accounting for 622,000 tons out of a total from all sources of 1,354,000 tons. This quantity represented nearly 46 per cent., as compared with the previous highest figure of 41 per cent. in 1933, and an average of only 20 per cent. in 1919-23. Imports from Empire countries of seven different fruits, namely, grapefruit, grapes, lemons, oranges, peaches, pineapples, and plums, were greater than those in any previous year, while imports of bananas were only just short of the record quantity imported in 1932, and apples, though much less than in 1933, were higher than in any other year. Imports of fresh fruit from Canada and Australia, which consist principally of apples, were smaller in 1934 than in 1933, but there were increased supplies from South Africa, New Zealand, the British West Indies, and Palestine, the aggregate quantities of fruit received from South Africa and Palestine constituting new records, while those from New Zealand and the British West Indies were heavier than in any year, except 1932.

The survey, in addition to its analysis of the imported supplies of fresh fruit in the United Kingdom, contains brief reviews of the trade in other countries, and should be invaluable to all those interested in an Empire industry of growing importance.

Orchard and Garden Notes

By Edward E. Pescott, F.L.S., Senior Horticultural Instructor.

A Hybrid Tea Rose.

The Flower Garden.

FULL attention should now be given to the roses. As the spring is moist, it is very likely that there will be plenty of mildew. This is seen as a grey colouring on the young leaves and shoots, which very quickly causes the shoots to wilt and die. As soon as mildew is noticed the bushes should be given a good dusting with sulphur, or else they should be sprayed with one of the forms of colloidal sulphur. This latter preparation has come into general use in other parts of the world, particularly in New Zealand, where it is recommended above all other forms of sulphur.

Aphis, too, has appeared very early this year; it should be constantly attacked with the nicotine sulphate spray.

As the weather becomes warmer the roses should be mulched over with the lawn grass clippings, or with old straw manure. The rods of climbing roses should be tied down more to a horizontal position so that buds may develop along the whole course of the shoot.

Various plants may be given a top-dressing of old manure or leaf-mould. If either of these is not available a sprinkling of sulphate of ammonia, used at the rate of 1 oz. per square yard, should be given, but it must not come in contact with the foliage. The plants for which the treatment is recommended include Rhododendron, Azalea, Lily of the Valley, Lilium, and plants of a similar character. Ferns may also receive the same treatment, but, again, care should be taken to avoid injuring the foliage.

The Vegetable Garden.

The wet winter and the spring rains, together with the absence of frost, have been responsible for a larger crop of slugs and snails this season than usual. Special requests have been received for definite instructions as to how these pests should be dealt with. The best known remedy is calcium arsenate, sometimes called arsenate of lime. This mixture was discovered a few years ago in the "truck" or vegetable lots of California where the European snail threatened the destruction of many hundreds of acres of good vegetable land.

There is no doubt of the efficacy of the remedy, and if used two or three times a year no plant loss should be experienced from snail attack.

The preparation is made by mixing one part by measurement of calcium arsenate with nine parts by measurement of bran, that is to say, nine cups or nine spoons of bran are mixed with nine cups or nine spoons of the calcium

arsenate. After thoroughly mixing, the preparation is sprinkled over with water which has been sweetened with molasses or treacle. The mixture is not made into a paste, but the whole is so thoroughly wetted that the powder adheres well to the bran. A good test is to take a handful and squeeeze it together, which, when opening, will fall again into a bran formation without remaining in a lump. The mixture is then scattered about the garden where plants are to be protected. It should not be distributed in large pieces, which are generally known as "baits"; if distributed in this form, domestic animals, as well as birds, might be poisoned. This remedy should be used both in the vegetable and flower garden, and it is especially needed where young seedlings have been planted out, or where flowers are showing their buds.

The Orchard.

The codling moth bands referred to in last issue should by this time be fastened on every apple and pear tree. It is important that every form of attack against the codling moth should be used so that the first brood may, as far as possible, be well checked. While it is not advanced that the bands alone will do the work, yet the use of bands and the placing of lures in the trees, combined with other methods of hygiene, are all very successful adjuncts to the arsenical spray programme. The bands should be placed on the trees with the corrugated side inside, and if there is any likelihood of bad weather, the tops may be turned over to throw off the rain drips. Various lures can be used in the pots, but it is recommended that a 10 per cent. solution of vinegar should be tried. The vinegar must be malt and strong smelling; that made from acetic acid does not attract the moths. The vinegar solution has given satisfaction in most codling moth areas. The bands and lures should be in place before the flowers open.

The importance is emphasized of the two first calyx sprays with arsenate of lead; the first should be given just before petal fall; the second a fortnight later. If the calyx sprays are missed, large loss will almost certainly follow.

Causes of the Short Victorian Vintage for 1935

(*Continued from page* 511).

more efficient, more adherent, and less costly than Bordeaux mixture if correctly made on the spot by a man who understands the operation. A most interesting substitute recently recommended by some French authorities is sulphide of copper, but as yet it has not been tried very widely, and there are some conflicting reports as to its efficacy. Though copper sulphide has no direct fungicidal action, its gradual oxidation provides minute quantities of copper sulphate, to which it owes its value as a spray.

Dusting powders must be considered only as supplementary to the standard Bordeaux treatment, but on no account as substitutes for it. They are very easily washed off, and may cause scorching. They have a certain value in that they can be quickly and easily applied, and at times when the ground is too wet to permit the spray cart to work dusting will provide temporary protection. Should a late attack of mildew occur, it is possible to blow dust into the centre of the vines and reach fruit which would be missed in an ordinary spraying.

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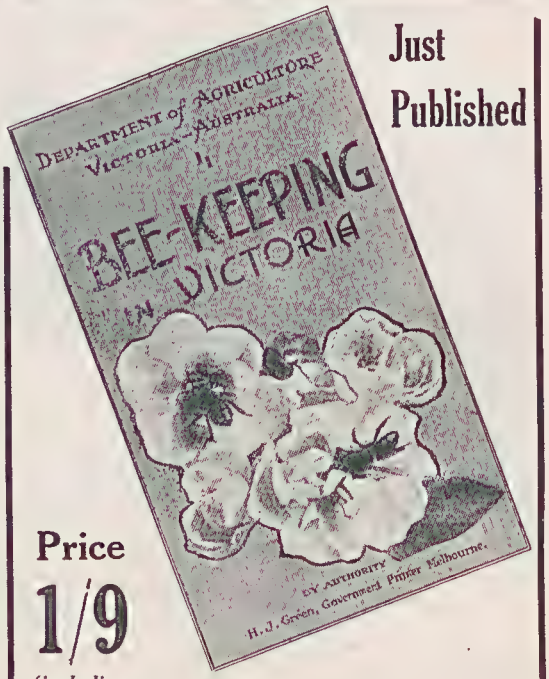

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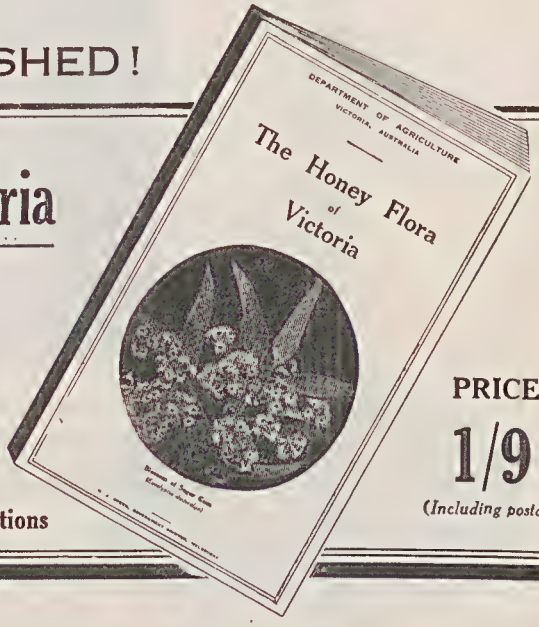

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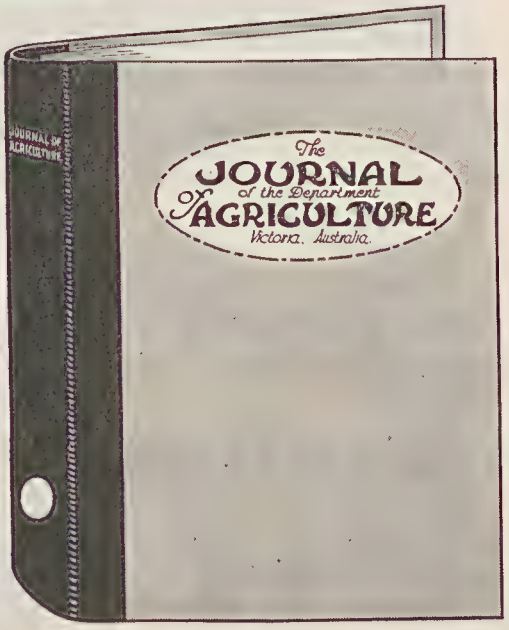

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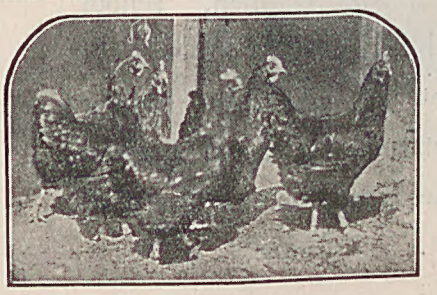

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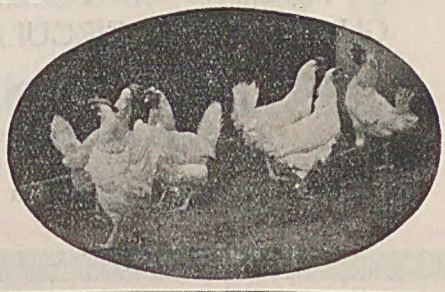

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